Montana
Department of Labor and Industry

Drilling for Workers:

A Workforce Assessment of the Energy Industry in Eastern Montana's WIRED Region

Montana Department of Labor and Industry
WORKFORCE SERVICES DIVISION

Research & Analysis BUREAU

Montana
Department of Labor and Industry

Drilling For Workers:

A Workforce Assessment of the Energy Industry in Eastern Montana's WIRED Region

State of Montana
Brian Schweitzer, Governor

Montana Department of Labor and Industry
Keith Kelly, Commissioner

Created by:
Research and Analysis Bureau
Todd Younkin, Bureau Chief

Contributors:
Eric Johnson, Program Manager
Barbara Wagner, Senior Economist
Aaron McNay, Economist

Montana Department of Labor and Industry
WORKFORCE SERVICES DIVISION

Research & Analysis BUREAU

Research and Analysis Bureau • 840 Helena Ave. • P.O. Box 1728 • Helena, MT 59624-1728 • (406) 444-2430 • (800) 541-3904 • www.ourfactsyourfuture.org

A Message from Commissioner Keith Kelly

As the commissioner of the Montana Department of Labor and Industry, it is my honor to present "Drilling for Workers: A Workforce Assessment of the energy industry in Eastern Montana's WIRED Region." Montana has great energy potential in both renewable and non-renewable sources, but do we have the workforce needed for these types of jobs in the WIRED Region?

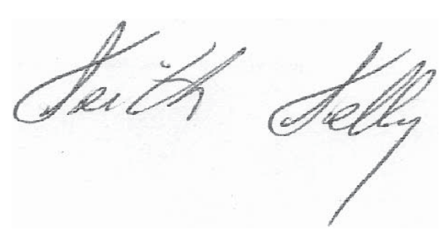
The Workforce Innovation in Regional Economic Development (WIRED) region is comprised of 32 counties and six Indian Reservations in Eastern Montana. For more than 50 years, the region has continued to lose a portion of its population, adding to the challenges it already faces. Along with out-migration, the region has lower-than-average education levels, low employment growth, and transportation and infrastructure shortages.

While this may seem like bad news, there is a wealth of opportunity within the WIRED region. Eastern Montana is rich in natural resources like coal, oil and natural gas; it also produces more than half of the state's agriculture products. As the energy industry continues to grow, many of the skills for occupations within the industry are similar to those needed for all types of jobs in Montana; this good news for those workers who have transferrable skills and want to move into the industry.

Many of the occupations within the energy industry do not require a formal education. In fact, the majority of jobs require short-term on-the-job training or related work experience; only 26% of energy jobs require on-the-job training that lasts more than one year. That means more of the workers within the WIRED region can use the skills they already have and participate in on-the-job training while receiving a paycheck.

Wage growth for different occupations within energy can vary; some occupations such as Rotary Drill Operators and Cost Estimators have seen tremendous wage increases, which is one sign of a labor shortage. There are ways we can address the workforce shortages in these areas by investing in new technology and tapping into our untapped labor markets.

The Department of Labor and Industry has partnered with business, education, and labor to alleviate unmet labor needs and support the continued growth of our economy; particularly in the energy sector. Our most precious natural resource is our workforce, and we need to make sure our workers have the tools they need for new energy industry jobs on the horizon.



Contents

Eastern Montana's Workforce Innovation in Regional Economic Development (WIRED) region faces many economic development challenges, including out-migration, lower-than-average education levels, low employment growth, and transportation and infrastructure shortages. Already a significant contributor to the region's economy, the energy industry presents new hope for economic prosperity in the WIRED region. However, Montana's energy industry faces many challenges for continued development, including the need for price stability, environmentally-sound production, infrastructure, and the maintenance of an appropriately-skilled workforce. Montana is well-poised to meet the challenges of building infrastructure and developing clean and price-stable energy sources. As such, this study will focus primarily on workforce challenges.

Labor market statistics suggest that Montana's energy industry has experienced a labor shortage in recent years, due to rapid industry growth and strong competition for similarly-skilled workers from other industries, particularly construction. Rotary Drill Operators, Truck Drivers, Mechanics, and Welders are among the occupations that demonstrate the strongest symptoms of a workforce shortage.

The economic downturn over the last year has eased competition for workers between industries and likely reduced worker shortages, therefore postponing the need for immediate action. However, future action may be needed to address the long-term workforce challenges and allow Montana's energy industry to grow. This report provides the data and information needed by leaders in business, worker unions, and government in order to make decisions about workforce issues in the energy industry.

Section I provides an overview of the WIRED region of eastern Montana, demonstrating that the region is more dependent on the natural resource economy and has less development in consumer-based industries than the rest of Montana. The lack of consumer-based industries, largely due to a low population density, has left the region out of the rapid economic growth that Montana's Construction and Leisure & Hospitality sectors have experienced in recent years.

Section II describes the current state of energy production in Montana. In brief, Montana has great potential to expand energy production in both renewable and nonrenewable sources of power. However, transportation and transmission infrastructure are limiting the development of existing resources, while technology advancements are needed to address the adverse impacts of power production on the environment. The current energy workforce includes 9,875 workers, most of whom gain their job skills primarily through work experience and on-the-job training, rather than through formal education programs.

Section III addresses workforce shortages in Montana's energy industry. Indications of a workforce shortage include a low unemployment rate in recent years, unexpected job growth within the energy industry, job growth in other industries that compete for workers with the energy industry, a higher and faster-growing average wage in the energy industry, wages growing faster for entry-level energy workers than for experienced workers, and wage growth that does not seem to be driven by productivity increases.

The report concludes with Section IV, which evaluates the options for addressing the workforce shortage. These options include investing in new technologies to automate certain production processes, finding new workers from within and outside of the energy industry, providing additional training to workers with skills similar to those needed in energy jobs, and keeping a strong focus on on-the-job and other non-formal training programs.

Introduction and Technical Information

In 2008, Montana's WIRED Project requested more information on reported workforce shortages in Montana's energy industry. The resulting report by the Research and Analysis Bureau of the Montana Department of Labor and Industry provides an analysis of the workforce shortage, as well as an examination of the WIRED region, and of the energy industry in Montana.

Section I provides an overview of the WIRED region, its economy, and the role of the energy sector within the WIRED region. Section II provides a description of the current energy industry, its workforce, and future challenges it will face in Montana. Section III investigates whether a labor shortage exists and identifies the energy industry occupations in greatest demand. Section IV concludes by outlining options to address workforce concerns.

Before getting into the numbers, however, it is important to address a few important technical concerns with the data presented in this report. The primary data sources were the U.S. Department of Labor (DOL), Bureau of Labor Statistics (BLS), and the Research and Analysis Bureau, including the Quarterly Census of Employment and Wages (QCEW), the Occupational Employment Survey (OES), and O*Net data on occupations. These sources include only payroll employment, which excludes self-employed workers or proprietors, and has the unfortunate side effect of excluding some energy workers from our study. When appropriate, we have also used data from U.S. Census Bureau and the Bureau of Economic Analysis (BEA), which include estimates of non-payroll employment. Confidentiality standards were maintained by replacing non-disclosable information with asterisks.

Additionally, DOL employment data is reported according to the business location, rather than the location where the work was actually performed. For example, the QCEW reports mining support activities in Missoula County. While some support activities may have taken place in Missoula, such as bookkeeping or management duties, this employment also likely included activities performed on coal mining sites within the WIRED region. Because of the difficulties in determining what portion of employment actually occurred within the WIRED region, this report uses the employment data from the full state of Montana. However, the data from the Census Bureau and the BEA used in the description of the WIRED region and its economy are specific to the WIRED counties.

This report defines the energy industry using the North American Industry Classification System (NAICS). Under NAICS, individual businesses are classified according to the primary activity of the business. The NAICS does not have one specific category that includes all energy businesses; therefore, multiple categories must be combined to obtain employment estimates for the energy industry. The following NAICS categories were considered the energy industry for the purposes of this report:

2111 - Oil and Gas Extraction
2121 - Coal Mining
2131 - Support activities for mining
2211 - Electric Power Generation, Transmission, and Distribution
2212 - Natural Gas Distribution
23712 - Oil and Gas Pipeline Construction and Related Structures Construction
23713 - Power and Communications Line and Related Structures Construction
3241 - Petroleum and Coal Products Manufacturing
4247 - Petroleum and Petroleum Products Merchant Wholesalers
4861 - Pipeline Transportation of Crude Oil
4862 - Pipeline Transportation of Natural Gas
4869 - Other Pipeline Transportation (Refined Oil)
56291 - Remediation

These categories provide a narrow definition of the energy industry and likely exclude some employment that might be considered part of the energy industry. For example, Gasoline Stations (NAICS 4471) are not included because these establishments have significant non-energy sales, and because growth is driven by consumption factors unrelated to the economic drivers of the energy industry. The more narrow definition was chosen because it ensured that only occupations specific to the energy industry were included in the occupational analysis.

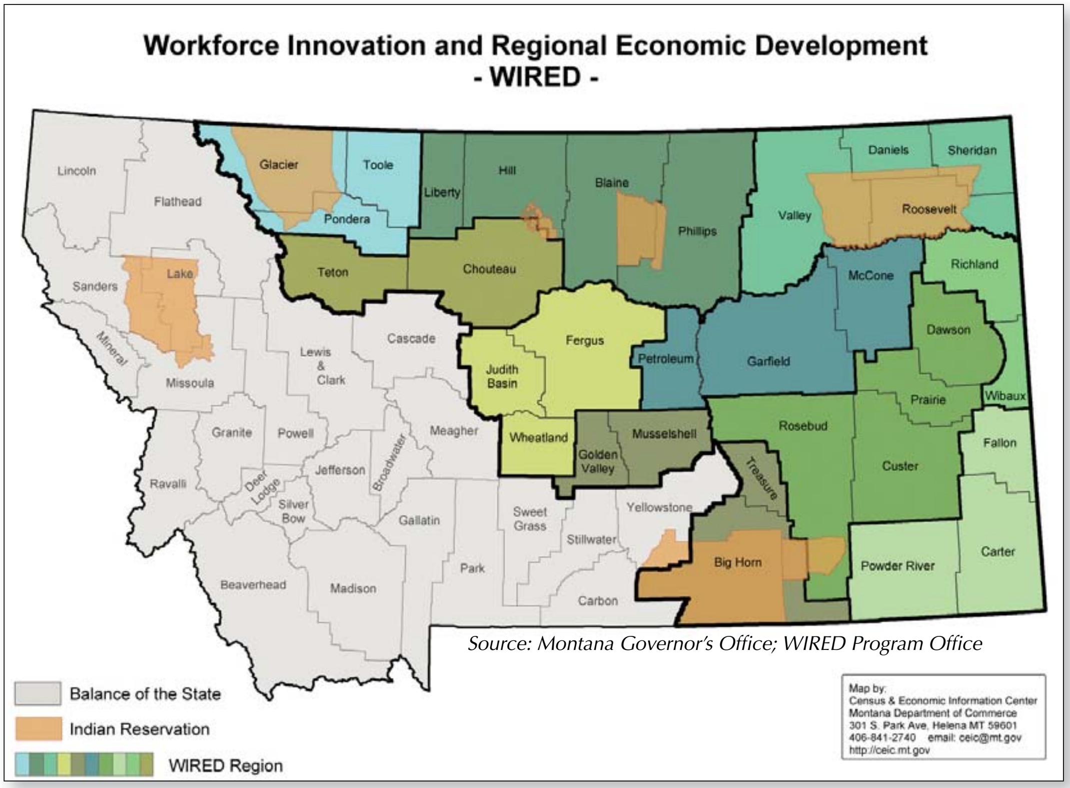
Further, businesses may conduct activities that fall under multiple NAICS codes, but are categorized only by the code that describes their primary business activity. As such, this report may exclude certain types of jobs that could be considered energy jobs, but are included in an unrelated NAICS code.

This definition of the energy industry also excludes most biofuel production in Montana, largely due to the low payroll employment in the biofuel industry. Biofuels are categorized into the following NAICS codes: 11111- Soybean Farming; 11112- Oilseed Farming; 325193- Ethyl Alcohol Manufacturing (Ethanol); 324110- Petroleum Refineries, or 325199- All other Basic Organic Chemical Manufacturing (which includes the mixing of oils to produce fuels, or biofuels). Only Petroleum Refineries are included in this definition of the energy industry. Employment in the excluded biofuels industries did not exceed 15 employees during the 2000-2007 period.

Section I: Overview of the WIRED Region of Eastern Montana

The Montana WIRED region includes 32 counties and six Indian Reservations in Eastern and North Central Montana. The area included in the WIRED region is shown in Figure 1.1.

Figure 1.1

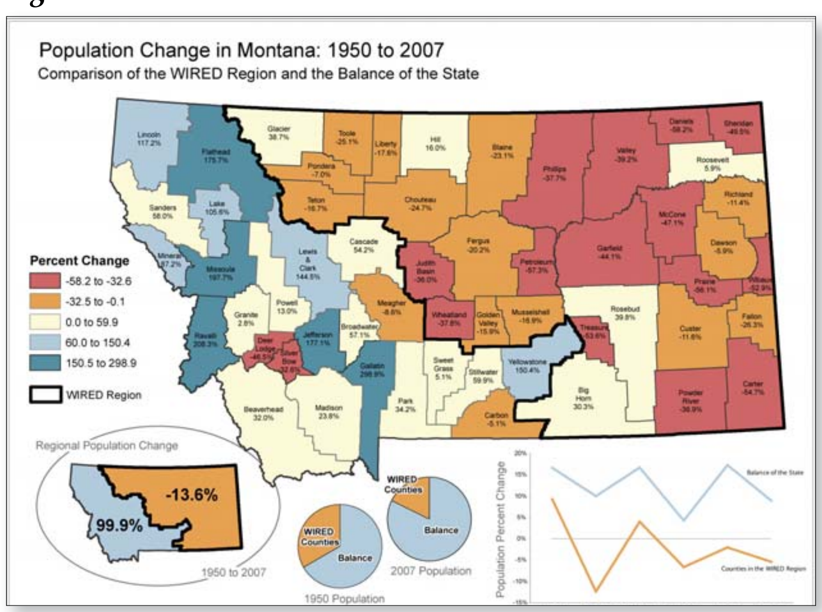


Source: Montana Governor's Office; WIRED Program Office

WIRED Population

The WIRED region is very rural, with a population density of 1.97 people per square land mile (2006), compared to 6.5 for the state, and 84.5 for the nation. Due to its isolation and lack of economic growth, the region has experienced long term population decline. Since 1950, the WIRED region has lost 13.6% of its population; in comparison, the balance of Montana has experienced a population increase of 99.9%.[1] As shown in Figure 1.2 (right), the population declines are greater in the counties that are further east.

Figure 1.2



[1] *U.S. Census Bureau, 1950, 2007, and 2006 Population Estimates, 2000 Land Square Mile Estimates. Available at www.census.gov.*

The average net outflow, or the outflow minus the inflow of people, to other Montana counties is about 500 people annually, as shown in Figure 1.3. During the 2000-2007 period, approximately 1,750 people from the WIRED region left Montana each year, with slightly more moving into the area in 2007. Of those who left the WIRED region during that period, 43% left the state, 13% moved to Billings, 5.4% moved to Great Falls, and 8.1% moved to other Montana counties.[2]

The population of the WIRED region is relatively older than the population of Montana as a whole. People who are 65 or older make up 15.8% of the total population in the WIRED region, compared to 13.9% for Montana as a whole, and 12.6% nationally.[3] An older population translates to an older workforce, with 21% of workers in the WIRED region being 55 or older, compared to 17.6% in the balance of Montana.[4]

The out-migration and aging of the area's workforce has resulted in a relatively low unemployment rate, despite having negative job growth over the past seventeen years. Figures 1.4 and 1.5 show the unemployment rate and annual job growth in the WIRED region compared to the balance of Montana from 1990 to 2007. Unemployment has been lower in the non-WIRED region since 1992, although both areas exhibit unemployment rates lower than 4%.

In the non-WIRED region, this low unemployment rate is a result of consistent, positive employment growth over the 1990-2007 period, as shown in Figure 1.5. Conversely, employment growth in the WIRED region is quite volatile, with many years of negative growth. From 1990 to 2007, the average annual compounding rate of job growth in the WIRED region was -0.3% compared to the positive growth of 1.8% in the non-WIRED counties.

Figure 1.3

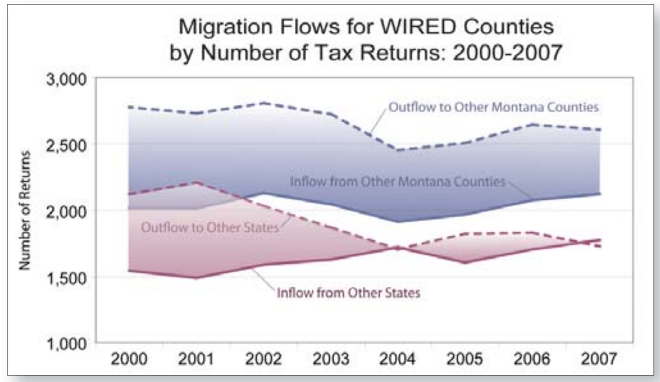


Figure 1.4

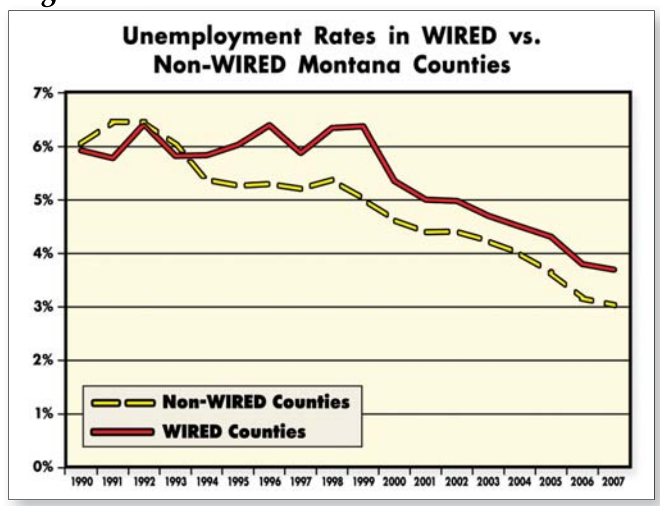
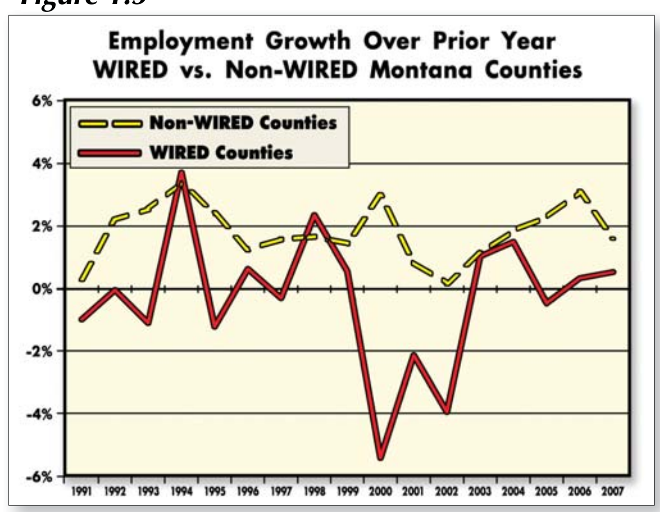


Figure 1.5



[2]Approximately 30% of the migrants move to a location that is unknown due to confidentiality standards. Data from the Internal Revenue Service, SOI Tax States- County to County Migration, 1999-2007, complied by the Census and Economic Information Center, Montana Department of Commerce.

[3]U.S. Census Bureau, 2007 Population Estimates. See footnote 1.

[4]U.S. Census Bureau, Center for Economic Studies. LEHD On-the-Map, Version 3. Available at http://lehd.did.census.gov/led/index.html. Accessed on Jan 15, 2009.

WIRED Education

In terms of educational attainment, the WIRED region outperforms the nation in the percentage of the population 25 and older with a high school diploma, but lags behind in the percentage of the population with some college education, as shown in Figure 1.6. The WIRED region lags behind the balance of the state in both the high school diploma and some college categories.

The disparity in education levels between the WIRED region and the rest of the state is likely beacuse of the types of jobs available within the region (and the education and skill levels required for those jobs), and because the largest educational institutions in Montana are located outside of the WIRED region. The educational institutions within the WIRED region include community colleges in Miles City and Glendive, tribal colleges on each reservation, and Montana State University – Havre. Although attendance data on the tribal and community colleges is not included, 2007 data from the Montana University System indicates that only 15.6% of students from the WIRED region attend Montana State University – Havre. The majority of postsecondary students from the WIRED region leave the area to attend schools in Bozeman, Missoula, or Billings, as illustrated in Figure 1.7.

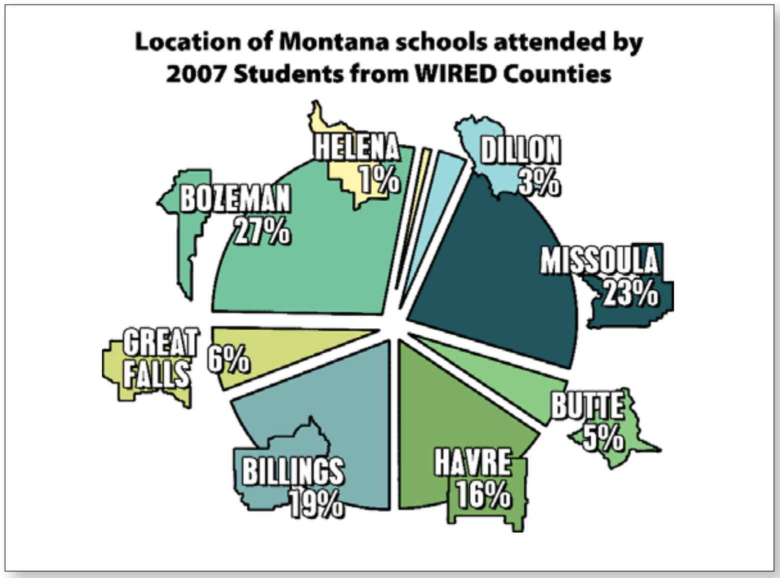
Figure 1.8 breaks down educational attainment into four categories to compare the 25 and older population in the WIRED region, the non-WIRED region, Montana as a whole, and the nation. The greatest disparity between the WIRED and non-WIRED regions exists in the bachelor's degree or higher category. In fact, only 4% of the WIRED population has a graduate or professional degree, compared to 8% of the non-WIRED population, and 9% nationally.

Figure 1.6

Educational Attainment of Population 25 and Older, 2000 Census

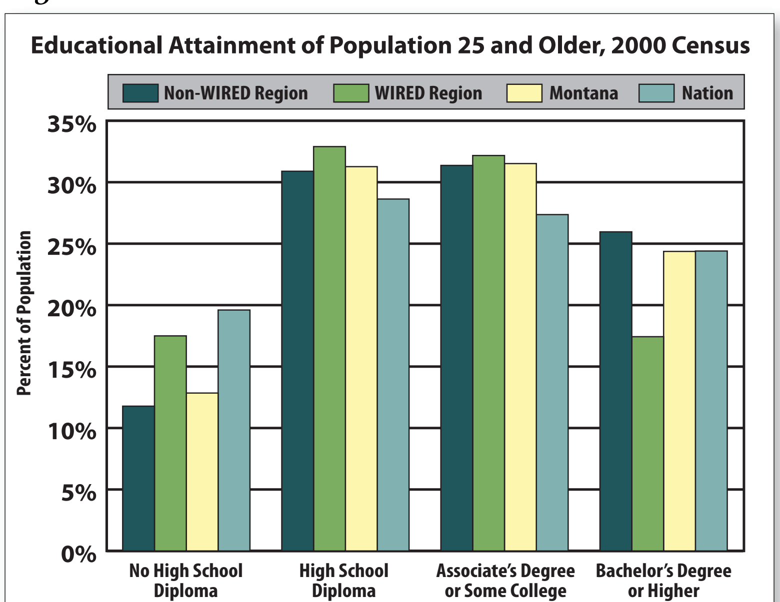
	Balance of State	WIRED Region	Nation
High School Diploma	88.2%	82.5%	80.4%
Some College	57.3%	49.6%	51.8%

Figure 1.7



Source: Montana University System, Office of the Commissioner of Higher Education. "High School Follow-up Report" Available at http://mus.edu/data/HS_follow-up.asp.

Figure 1.8



The WIRED Economy

Traditionally, Montana's WIRED region has been considered the agricultural region of the state, with little diversification into alternate base industries. The WIRED region includes 74.9% of the agricultural land in Montana (with only 59.5% of the state's land area) and produces 63.1% of the state's agricultural products.[5] However, the move toward more capital intensive agricultural production has slowly decreased the employment opportunities within the industry, leaving the region searching for alternatives. The energy industry provides an alternative for economic prosperity in the WIRED region.

The energy industry already plays an important role in the WIRED region. Figure 1.9 shows the percentage of earnings from work for each industry for the WIRED region, compared to the non-WIRED region and Montana as a whole. In 2005, the mining industry, which includes the mining of coal, oil, and gas, along with the support activities for mining, provided 6.8% of the work earnings for the WIRED region. In contrast, the non-WIRED balance of the state only received 2.7% of its earnings from the mining industry.

Figure 1.9

Percent of 2005 Work Earnings by Industry, WIRED Counties compared to Balance of State

	Montana	WIRED Counties	Non-WIRED Counties
Farm	2.5%	10.9%	1.0%
Forestry, fishing, and related Activities	1.0%	1.4%	0.9%
Mining	3.3%	6.8%	2.7%
Utilities	1.9%	4.1%	1.5%
Construction	8.4%	6.5%	8.7%
Manufacturing	5.8%	2.2%	6.5%
Petroleum and coal products manufacturing	1.0%	0.3%	1.1%
Wholesale trade	4.1%	2.8%	4.4%
Retail trade	8.3%	6.1%	8.7%
Transportation and warehousing	4.0%	6.0%	3.7%
Pipeline Transportation	0.1%	0.5%	0.0%
Information	1.9%	1.8%	2.0%
Finance and Insurance	4.4%	2.8%	4.7%
Real Estate and Rental and Leasing	3.2%	1.2%	3.6%
Professional and technical services	6.2%	2.4%	6.9%
Management of companies and enterprises	0.3%	0.1%	0.3%
Administrative and waste services	2.4%	0.9%	2.6%
Waste Management and remediation services	0.2%	0.1%	0.2%
Education Services	0.5%	0.2%	0.6%
Health care and social assistance	11.8%	8.2%	12.4%
Arts, entertainment, and recreation	1.2%	0.8%	1.2%
Accommodation and food services	3.5%	2.6%	3.7%
Other services, except public administration	3.2%	2.8%	3.2%
Federal Government	5.5%	7.9%	5.1%
Military	2.3%	1.1%	2.5%
State and Local Government	14.3%	20.3%	13.2%
Combined Energy Industry	6.4%	11.8%	5.5%

Source: Bureau of Economic Analysis, Regional Economic Accounts, 2005.

Other industries included in the energy industry are utilities, petroleum and coal product manufacturing, pipeline transportation, and remediation activities. The combined work earnings for these energy-related industries make up approximately 11.8% of the earnings in the WIRED region.[6] In comparison, earnings from farms represent 10.9% of the region's work earnings.

In addition, some of the earnings from other industries can be attributed to the spillover effects of exporting energy. Economic base theory, a popular theory of regional development, focuses on exporting industries as the primary driver of economic growth in a region. While many industries, such as retail, represent a transfer of money from one entity to another within the region, exporting

[5] *Agricultural land estimates from Montana Department of Revenue, 2006. Biennial Report, July 1, 2004 to June 30, 2006. 2006 acres of land that is classified as Class 3 Agricultural Land. Available at http://mt.gov/revenue/publicationsreports/biennialreports/biennialreports.asp. Market Value of Agricultural production in Montana from U.S. Department of Agriculture, National Agricultural Statistics Service. 2002 Census of Agriculture.*

[6] *Does not include earnings from the construction of energy facilities or any earnings from government oversight of the energy industry.*

industries bring new money into the region and add to the region's wealth. Although employment in base industries may be smaller than in other industries, the base industries are important because the new wealth from exports allows for a greater amount of activity and jobs in other non-base industries, like retail. For example, for every job in the energy sector, 2.3 jobs are created in other sectors.[7]

One of the shortcomings of economic base theory, however, is that it places less emphasis on the rapid employment growth that occurs in consumer-based, population-driven industries. Consumer-based industries, such as health care, construction, retail and wholesale trade, and accommodations and food services, have been driving employment growth in the nation and in Montana in the last few years. For example, consumer-based industries in Montana added almost 33,000 jobs to the Montana economy in the last five years, while natural resource industries only added 3,200 jobs.[8]

Montana's WIRED region has very little concentration of rapidly-growing, consumer-based industries due to low demand from the declining population. The lack of such industries may help explain why the region has lower employment growth than the rest of Montana. Lower employment growth has resulted in lower wages as well. In 2007, the average wage per job in the WIRED region was $29,200, while the average wage statewide was $32,200.[9]

Figure 1.10

Employment and Wage Growth in the WIRED Region and Montana

	WIRED REGION				MONTANA			
	Employment	Employment Growth	Wages	Wage Growth	Employment	Employment Growth	Wages	Wage Growth
2000	57,134		$21,380		379,011		$24,276	
2001	57,059	-0.1%	$22,307	4.3%	383,996	1.3%	$25,195	3.8%
2002	57,148	0.2%	$23,111	3.6%	388,161	1.1%	$26,001	3.2%
2003	59,031	3.3%	$23,938	3.6%	393,521	1.4%	$26,927	3.6%
2004	59,911	1.5%	$24,863	3.9%	403,521	2.5%	$27,832	3.4%
2005	60,263	0.6%	$26,250	5.6%	413,432	2.5%	$29,157	4.8%
2006	61,092	1.4%	$27,753	5.7%	426,220	3.1%	$30,607	5.0%
2007	62,132	1.7%	$29,213	5.3%	436,695	2.5%	$32,223	5.3%
Annual Compounding Rate of Growth 2000-2007		1.2%		4.6%		2.0%		4.1%

Source: Quarterly Census of Employment and Wages, Bureau of Labor Statistics

It is interesting to note, however, that wages in the WIRED region have grown at a faster rate than wages in Montana as a whole during the 2000-2007 time period (a compounding annual growth rate of 4.6% compared to 4.1%), despite having slower job growth. The employment and wage growth in the WIRED region is shown in Figure 1.10. The higher wage growth may be due to the higher-wage energy jobs being added in the WIRED region. Energy jobs in Montana have an average salary of $67,280, or 230% higher than the average wage in the WIRED region.

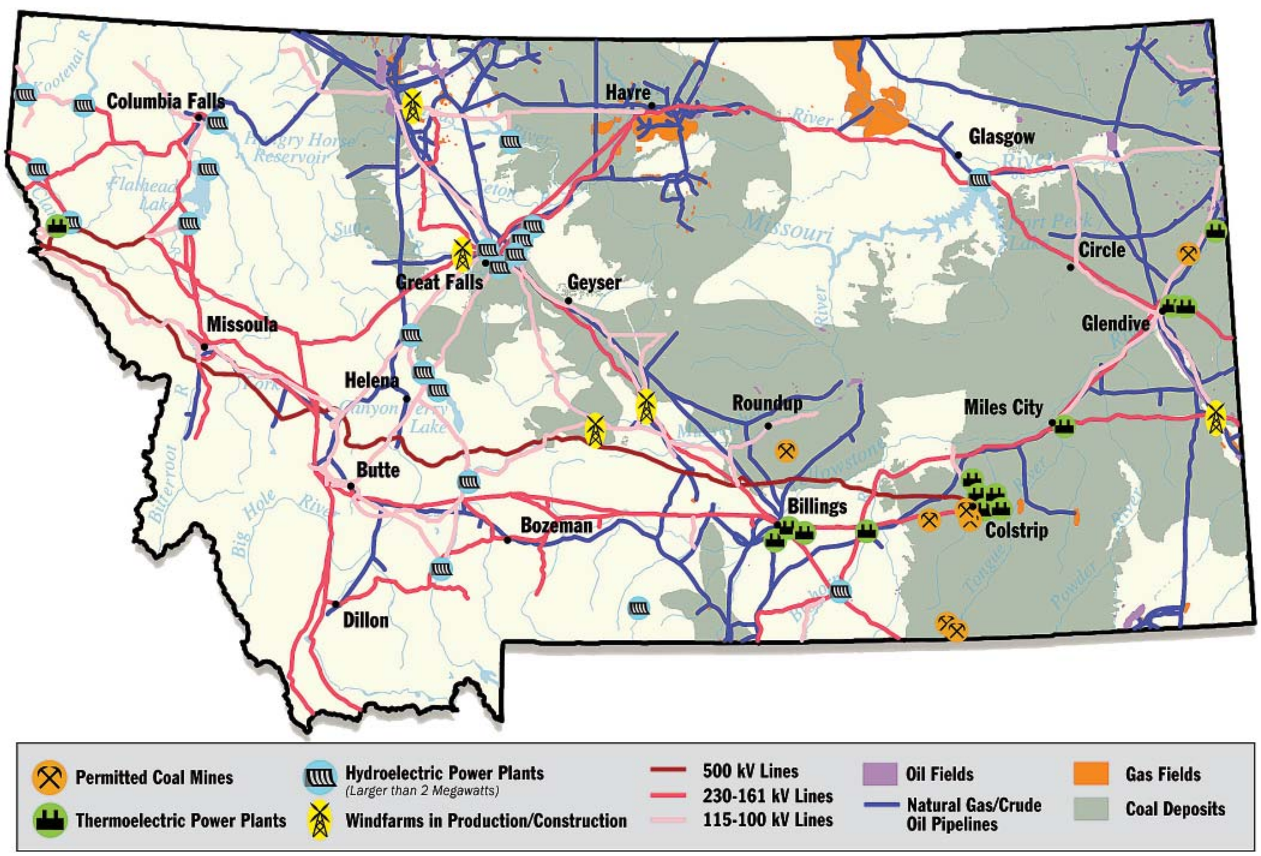
[7]Unadjusted Type II employment multipliers from IMPLAN software with 2004 data for Montana. "Energy Industry" is an aggregated industry of the following energy-related sectors: oilseed farming; oil and gas extraction; coal mining; drilling oil and gas wells; support activities for oil and gas operations and other mining; power generation and supply; natural gas distribution; water sewer and pipeline construction; petroleum refineries; oil and gas field machinery; electric power manufacturing; pipeline transportation; and federal electric utilities.

[8]Quarterly Census of Employment and Wages, 2002 and 2007, 2-digit NAICS codes. Industries included in "natural resource industries" include: agriculture, forestry, and fishing; mining, oil, and gas extraction; utilities; and manufacturing. Consumer-based industries include: construction; retail trade; real estate and rentals; other services; healthcare and social assistance; arts, entertainment, and recreation; public administration; education; and accommodations.

[9]Quarterly Census of Employment and Wages, 2007.

SECTION II: Energy Production in Montana

Figure 2.1 **Energy Resources, Major Pipelines and Transmission Lines**



Montana's energy sector consists primarily of nonrenewable forms of energy production. Montana typically accounts for four percent of total annual U.S. coal production and two percent of crude oil production.[10] Coal, natural gas, and oil are exported out of state, providing Montana with an important base industry. In 2007, Montana's exports of coal, oil, and natural gas totaled over $54.8 million. In comparison, exports of wood products were approximately $36.5 million.[11] Coal is also used in the value-added production of 1,652 megawatts of coal-derived electricity, most of which is exported out of the state to profitable West Coast markets.[12]

Montana also produces a small, but growing amount of electricity from renewable energy sources. Montana accounts for 4.4% of the total U.S. hydroelectric power, producing 883 megawatts in 2008. Montana is ranked the best state in the nation for wind energy potential. Although production is currently small at 271 megawatts in 2008, Montana is the fastest growing state for wind power generation, moving from 50th in the nation to 15th in the nation for wind energy production.[13] There are currently 45 wind projects in various stages of discussion and planning, with five wind farms in construction and production. Three of the five existing wind farms will be expanding in 2009, resulting in additional production capacity of 165 megawatts.[14]

[10] U.S. Department of Energy, Energy Information Administration. Montana State Energy Profile and U.S. Energy Statistics. Coal-fired electricity production is 2007 figure. Estimated coal reserves from producing mines use 2006 data. Electric generation figures are December 2008 data.

[11] WISER, at http://www.wisertrade.org from U.S. Census Bureau, Foreign Trade Division.

[12] U.S. Department of Energy, Energy Information Administration. See footnote 10.

[13, 14] U.S. Department of Energy, Energy Information Administration . See footnote 10.

Although the majority of coal, oil, and gas production in Montana occurs within the WIRED region, the benefits of this production are enjoyed by those in Western Montana as well. Taxes from coal, oil, and gas production are a significant source of revenues for state and local governments, particularly local school districts. In FY2008, the state received $206.9 million in coal, oil, and gas tax revenues for the state general fund, while local governments and school districts received $170.6 million.[15]

Energy Production within the WIRED Region

Most of the coal, oil, and natural gas mining in Montana occurs within the WIRED region. Richland County produces 58% of Montana's oil, while Bighorn County dominates coal production in Montana, producing 62% of Montana's coal annually.[16]

The WIRED region also leads the state in the electricity generating capacity. As Figure 2.2 shows, the WIRED region has the capacity to generate the majority of Montana's coal, wind, and petroleum-based electric power, as well as 18.5% of the state's hydroelectric power.

Figure 2.2

Montana Electric Power Generating Capacity by Energy Source, Aug. 2007 (Megawatts-MW)

	State Total		% of Summer Capability in WIRED Region
Energy Source	Summer Capability	Winter Capability	
Water (Hydroelectric)	2,679.8	2,524.1	18.5%
Wind	39.9	39.9	95.0%
Coal (any type) and Coal Blends	2,464.3	2,460.1	93.1%
Natural Gas	49.5	49.5	0.0%
Petroleum and Petroleum/ Natural Gas Blends	158.20	173.70	64.0%

Source: Montana Department of Environmental Quality, Historical Energy Statistics, Electricity Tables Workbook - 2007 Update. Accessible at http://deq.mt.gov/Energy/HistoricalEnergy/index.asp.

The Current Energy Workforce

In 2007, energy jobs paid an average annual salary of $67,280 compared to the Montana average of $32,220. The higher-than-average wages give the energy industry a greater importance in the Montana economy than portrayed by its employment level. The energy industry employed 2.3% of the state's workforce (9,875 workers) in 2007, yet provided close to $664 million in wages. By comparison, the Accommodations and Food Service industry employed 10.7% of the workforce (46,738 workers), yet only paid $592 million in wages.

Figure 2.3 displays the annual employment in Montana's energy industry by detailed sector for 2000 through 2007. Electric Power Generation, Transmission, and Distribution was the largest sector for every year except 2006, when Support Activities for Mining hit an employment peak. The sector with the largest employment increase was Support Activities for Mining, which expanded by 1,500 jobs. However, the fastest growing sector, percentage-wise, was the Remediation industry, which reclaims mining sites and removes hazardous materials during and after mine production. Petroleum and Petroleum Products Merchant Wholesalers; and Electric Power Generation, Transmission, and Distribution were the only sectors showing job losses from 2000 to 2007.

[15]Montana Department of Revenue, Biennial Report, 2007-2008. Available at http://mt.gov/revenue/publicationsreports/biennialreports/2007-2008biennialreport.pdf.

[16]2007 Production of oil and gas from Montana Board of Oil and Gas, On-line Data System. Accessible at http://bogc.dnrc.mt.gov/onlinedata.asp. Accessed on September 30, 2008. 2003 Coal Production by County, Department of Environmental Quality, Historical Energy Statistics, Coal Tables Workbook. Available at http://deq.mt.gov/Energy/HistoricalEnergy/index.asp. Accessed on September 30, 2008.

[17]Quarterly Census of Employment and Wages, Bureau of Labor Statistics. Provided by the Research and Analysis Bureau, Montana Department of Labor and Industry.

Figure 2.3

Annual Employment in Montana's Energy Sector by Detailed Industry 2000-2007, with 2007 Average Wage

Detailed Sector	2000	2001	2002	2003	2004	2005	2006	2007	2007 Avg. Wage
2111- Oil and Gas Extraction	492	490	424	337	467	548	607	640	$75,954
2121- Coal Mining	788	767	746	693	706	729	797	805	$69,370
2131- Support Activities for Mining	846	1,039	1,090	1,125	1,697	2,150	2,537	2,345	$64,052
2211- Electric Power Generation, Transmission, and Distribution	2,799	2,700	2,450	2,352	2,290	2,313	2,379	2,428	$72,096
2212- Natural Gas Distribution	248	238	238	237	395	383	392	399	$66,964
23712- Oil and Gas Pipeline and Related Structures Construction	87	103	95	371	358	371	385	461	$62,878
23713- Power and Communications Line Construction	544	556	436	335	512	444	580	580	$56,785
3241- Petroleum and Coal Products Manufacturing	909	929	946	927	893	943	951	975	$91,705
4247- Petroleum and Petroleum Products Merchant Wholesalers	668	672	701	686	607	627	648	644	$33,096
4861- Pipeline Transportation of Crude Oil	17	16	21	23	29	32	22	21	$73,588
4862- Pipeline Transportation of Natural Gas	*	174	173	173	188	200	206	226	$62,408
4869- Other Pipeline Transportation (Refined Oil)	77	81	67	62	69	91	100	108	$66,571
56291- Remediation	29	33	36	170	178	182	240	243	$51,419
Total Employment	7,504	7,798	7,423	7,491	8,389	9,013	9,844	9,875	$67,282

The energy workforce can also be described by the types of occupations within the industry. There is a tendency to view jobs in the energy industry in terms of traditional core occupations, such as the iconic coal miner in a hard hat. However, energy jobs include many other non-traditional occupations, including support staff and managers. For example, a search on Monster.com for "wind power jobs" returned 335 listings, including engineers, attorneys (land/real estate), contract managers, field service technicians, inventory managers, safety specialists, and receptionists. In fact, only 27.4% of the workers in the energy industry are the traditional construction or extraction workers, as Figure 2.4 illustrates.

Large occupational categories are general groups that include a number of more specific occupations. For example, occupations within the general category of Construction and Extraction include Carpenters, Electricians, and Roustabouts. Other occupational groups with significant employment include: Installation, Maintenance, and Repair occupations; Transportation and Moving occupations; and Office and Administrative occupations. These top four general categories comprise 70% of the energy industry workforce in Montana.

Figure 2.4

Types of Jobs in the Montana Energy Industry, Large Occupation Groups, 2007

Rank	Occupation Group	% of Total Industry Employment	Average Wage (Rounded)
1	Construction and Extraction	27.4%	$45,680
2	Installation, Maintenance, and Repair	16.8%	$54,570
3	Transportation and Material Moving	12.9%	$37,900
4	Office and Administrative Support	12.8%	$35,310
5	Production	9.3%	$54,740
6	Management	6.0%	$86,600
7	Architecture and Engineering	5.4%	$63,920
8	Business and Financial Operations	3.4%	$62,310
9	Life, Physical, and Social Science	1.5%	$65,380
10	Computer and Mathematical	1.5%	$65,090

Source: Occupational Employment Statistics, 2007

Figure 2.5

Top Occupations in the Montana Energy Industry, Detailed Occupation, 2007

Rank	Occupations	% of Total Industry Employment	Avg. Wage (Rounded)
1	Electrical Power-Line Installers and Repairers	6.7%	$59,500
2	Derrick Operators, Oil and Gas	5.0%	$45,430
3	Truck Drivers, Heavy and Tractor-Trailer	3.9%	$36,210
4	Bookkeeping, Accounting, and Auditing Clerks	3.9%	$33,380
5	Petroleum Pump System Operators, Refinery Operators, and Gaugers	3.6%	$56,360
6	Roustabouts, Oil and Gas	3.2%	$36,380
7	General and Operations Managers	3.0%	$95,990
8	Laborers and Freight, Stock, and Material Movers, Hand	2.8%	$31,540
9	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers	2.6%	$66,070
10	Rotary Drill Operators, Oil and Gas	2.5%	$51,950

Source: Occupational Employment Statistics, 2007

Figure 2.5 shows the largest detailed occupations in the Montana energy industry. Many of the occupations are traditional, such as Derrick Operators and Roustabouts, but many are those not specifically associated with the energy industry, such as Bookkeeping Clerks and Truck Drivers.

With the majority of energy industry workers in trades occupations, it should come as no surprise that the education and training requirements focus on work experience more than educational attainment. Figure 2.6 breaks down Montana's energy jobs by the minimum education requirements. Only 15% of energy jobs require a bachelor's degree or higher, and only 5% require an associate's degree or vocational award. Moderate-term on-the-job training is the largest category.

Figure 2.6

Minimum Education Requirements for Montana Energy Jobs, 2007

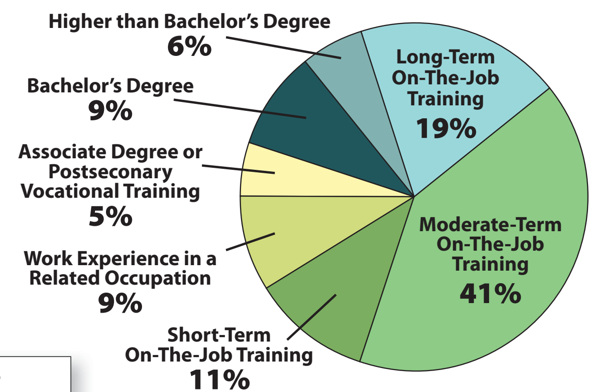


Figure 2.7

Work Experience Requirements for Montana Energy Jobs, 2007

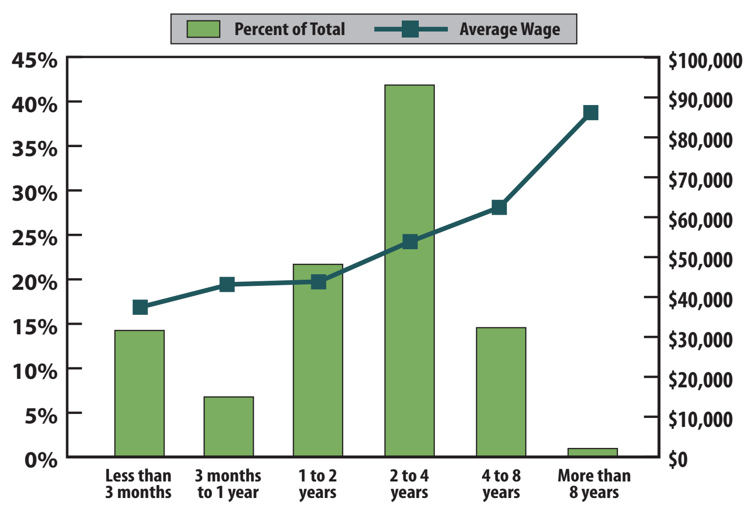
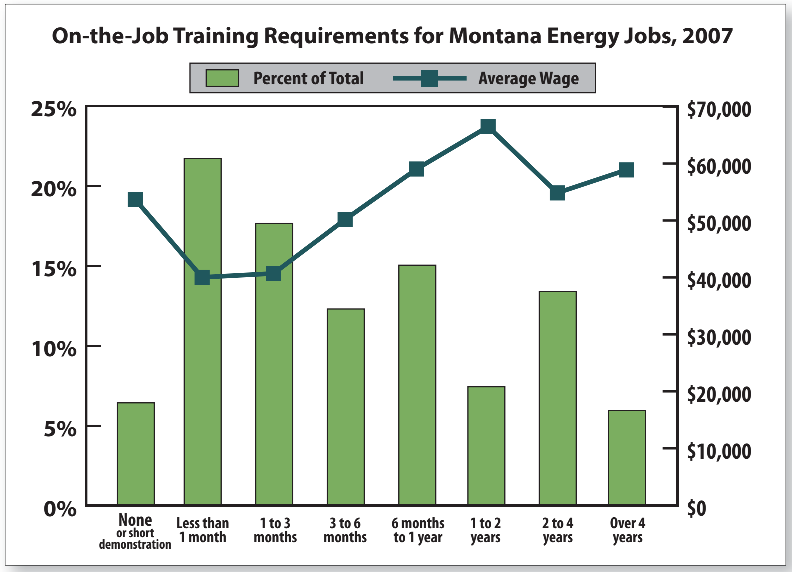


Figure 2.7 takes education levels out of the equation to focus on the importance of work experience in the energy industry. Over 41% of energy jobs require 2-4 years of related work experience, while 22% require 1-2 years. Wages increase significantly according to the length of work experience. Jobs requiring 2-4 years of experience pay $53,800 per year, on average, which is approximately $10,100 more than jobs that require only 1-2 years experience.

Figure 2.8 shows the amount of on-the-job training required for Montana energy jobs. While work experience can be gained from different employers or in different occupations, many of Montana's energy workers also require on-the-job training in order to learn specific skills unique to the position and the company. Only 6% of energy jobs can be performed with no training or a short demonstration. Over 26% of energy jobs require on-the-job training lasting over one year.

Figure 2.8



In general, the skills required to perform energy jobs are very similar to those needed for all types of jobs in Montana, indicating that all Montana workers are potential workers for the energy industry. The O*Net system provides information on the importance of 35 various job skills in energy occupations, organized into two different types: basic skills and cross-functional skills. A basic skill is usually developed through education, and helps facilitate learning and information gathering. A cross-functional skill helps facilitate job performance, and is usually developed through on-the-job experience. Both basic and cross-functional skills are not job specific and can be easily transferred into other occupations. The skills are shown in the Figure 2.9 (below and continued on the next page).

Figure 2.9

Skills Required for Montana Energy Jobs that are Similar to those Required for Other Jobs in Montana

	Skill	Description	Importance Score: All MT Industries	Importance Score: Energy Industry
Basic Skills	Reading Comprehension	Understanding written sentences and paragraphs in work related situations.	3.7	3.7
Basic Skills	Active Listening	Giving full attention to what other people are saying, taking time to understand the points being made, asking appropriate questions, and not making inappropriate interruptions.	4.0	3.9
Basic Skills	Writing	Communicating effectively in writing as appropriate for the needs of the audience.	3.2	3.1
Basic Skills	Speaking	Talking to others to convey information effectively.	3.7	3.5
Basic Skills	Mathematics	Using mathematics to solve problems.	3.1	3.3
Basic Skills	Science	Using scientific rules and methods to solve problems.	1.8	2.1
Basic Skills	Critical Thinking	Using logic and reasoning to identify the strengths and weaknesses of alternate solutions to problems.	3.4	3.6
Basic Skills	Active Learning	Understanding the implications of new information for both current and future problem-solving and decision-making.	3.3	3.4
Basic Skills	Learning Strategies	Selecting and using training methods and procedures appropriate for the situation when learning or teaching new things.	3.2	3.3
Basic Skills	Monitoring	Monitoring or assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.	3.1	3.3

Figure 2.9 (continued from previous page)

Skills Required for Montana Energy Jobs that are Similar to those Required for Other Jobs in Montana

	Skill	Description	Importance Score: All MT Industries	Importance Score: Energy Industry
Cross-Functional Skills	Coordination	Adjusting actions in relation to others' actions	3.3	3.5
	Persuasion	Persuading others to change their minds or behavior	2.7	2.7
	Negotiation	Bringing others together and trying to reconcile differences.	2.7	2.7
	Instructing	Teaching others how to do something.	3.3	3.4
	Service Orientation	Actively looking for ways to help people.	3.2	3.0
	Complex Problem Solving	Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.	2.8	3.1
	Operations Analysis	Analyzing needs and product requirements to create a design.	2.1	2.4
	Technology Design	Generating or adapting equipment and technology to serve user needs.	1.9	2.4
	Equipment Selection	Determining the types of tools needed for a job.	2.5	3.2
	Installation	Installing equipment, machines, wiring, or programs according to specifications.	1.9	2.7
	Programming	Writing computer programs for various purposes.	1.5	1.7
	Operation Monitoring	Watching gauges, dials, or other indicators to make sure a machine is working properly.	2.2	3.1
	Operation and Control	Controlling operations of equipment or systems.	2.3	3.0
	Equipment Maintenance	Performing routine maintenance on equipment and determining when and what kind of maintenance is needed.	2.3	3.1
	Troubleshooting	Determining causes of operating errors and deciding what to do about it.	2.5	3.3
	Repairing	Repairing machines or systems using the needed tools.	2.0	2.8
	Quality Control Analysis	Conducting tests and inspections of products, services, or processes to evaluate quality or performance.	2.3	2.7
	Judgment & Decision Making	Considering the relative costs and benefits of potential actions to choose the appropriate one.	3.1	3.4
	Systems Analysis	Determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes.	2.2	2.7
	Systems Evaluation	Identifying measures of indicators of system performance and the actions needed to improve or correct performance relative to the goals of the system.	2.2	2.6
	Time Management	Managing one's own time and the time of others.	3.4	3.5
	Management of Financial Resources	Determining how money will be spent to get the work done and accounting for theses expenditures.	2.1	2.3
	Management of Material Resources	Obtaining and seeing to the appropriate use of equipment, facilities, and materials needed to do certain work.	2.6	2.8
	Management of Personnel Resources	Motivating, developing, and directing people as they work, identifying the best people for the job.	2.2	2.6

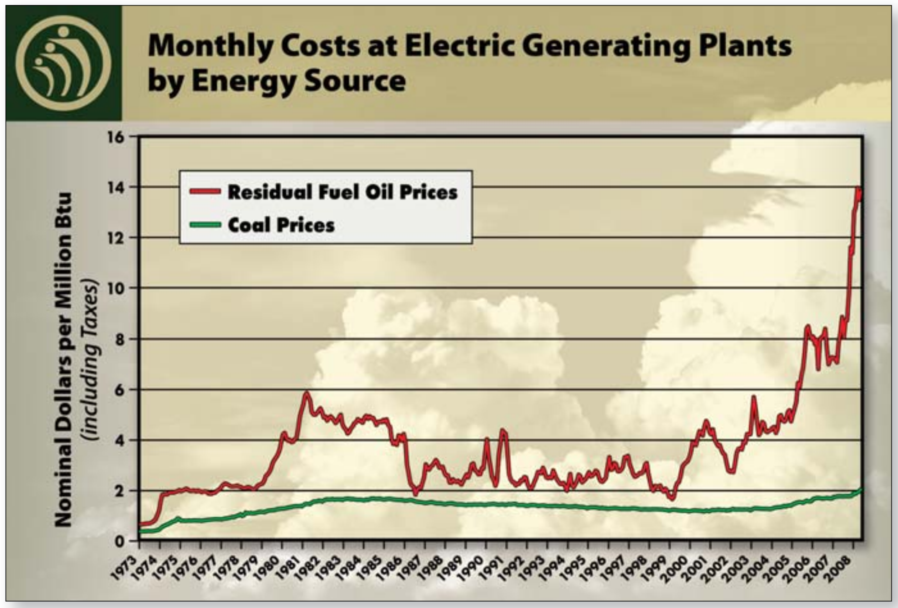
Figure 2.9 displays the relative importance of each skill on a scale of one to five for the average job in the energy industry compared to the average job in the economy as a whole. The importance score measures how often the skill is used in performing the work. For example, Active Listening scores fairly high for both the energy industry and all industries combined, with scores of 3.9 and 4.0 out of 5.0, respectively. On average, jobs in the energy industry require more use of complex problem solving, technology design, equipment selection, installation, operation monitoring, operation and control, equipment maintenance, troubleshooting, repairing, quality control analysis, system analysis, and system evaluation skills than jobs in other industries.

Although the energy industry places greater emphasis on some skills, the difference between the energy industry and all industries is not statistically significant for any of the 35 skills. This is encouraging news for energy businesses who are attempting to recruit new workers because it suggests that workers with the required mix of skills already exist within the Montana workforce and could be retrained for the energy industry through on-the-job training.

Future Challenges to the Energy Industry and its Workforce

The future of the energy industry in Montana and in the nation will be shaped by the need to minimize price volatility while reducing our dependence on nonrenewable and foreign sources of energy. Montana's vast natural resources make the state particularly suited to responding to these challenges using both renewable and conventional power sources. To meet these challenges, Montana must address the current constraints of transmission and transportation infrastructure, clean energy technology, and workforce needs.

Figure 2.10



The stability of coal prices makes coal an ideal energy source to provide cheap and reliable energy to consumers from a domestic source. Figure 2.10 illustrates the monthly costs paid by electric generating plants for coal and oil by BTU from 1973 to mid-2008. Oil prices are significantly more volatile than coal prices, which makes it difficult for generation plants to manage supplies and for consumers to manage budgets. In comparison, coal prices are cheaper and less volatile than oil. With more than one-fourth of the total U.S. coal reserves and an estimated 1.2 billion short tons of recoverable coal at producing mines, Montana has many opportunities for coal-derived power production, which will help minimize the volatility of Montana-made power.[18]

However, transportation infrastructure has limited the further development of coal mining and energy production in Montana. Rail shipment costs for coal from the Powder River Basin to power plants accounts for as much as 80% of the delivered price of coal.[19] Recent research published in the American Journal of Agricultural Economics indicates that utilization of coal from the Powder River Basin in Montana and Wyoming is not influenced by environmental policy or tax rates, as often suggested, but by other factors:

> *Evidence from the last twenty years also suggests a limited scope for strategic behavior by state governments in the PRB. Over the period 1980-2000, Wyoming coal production more than tripled from 94 million tons to 340 million tons, while Montana coal production increased only slightly from 30 million tons to 38 million tons. At least three factors appear to explain the differing fortunes of the coal industry in the two states: (1) largely because of lower in situ ratios (bank cubic yards of overburden moved per ton of recoverable coal), coal production costs have remained substantially lower in Wyoming than in Montana; (2) Wyoming coal is generally of higher quality and contains fewer impurities than Montana coals; and (3) the transportation infrastructure out of Wyoming is better developed than its counterpart out of Montana.*[20]

[18] *U.S. Department of Energy, Energy Information Administration. See footnote 10.*

[19] *Gerking, Shelby and Hamilton, Stephen F. 2008. Increased Use of Powder River Basin Coal, American Journal of Agricultural Economics. Vol 90, N 4, p 935. November 2008*

[20] *Gerking, Shelby and Hamilton, Stephen F. 2008. See Footnote 19.*

In addition to these limitations, coal is one of the least environmentally friendly energy sources for power generation. Coal emits 2.13 pounds of carbon dioxide per kilowatt-hour of power generated, compared to 1.56 pounds for oil and 1.03 for natural gas. Coal also emits 0.0076 pounds of nitrogen oxides per kilowatt-hour of power generated, compared to 0.0021 for oil and 0.0018 for natural gas. Although Montana's coal has lower sulfur content than coal produced in the Eastern U.S. (which may provide opportunities for clean-coal energy), addressing environmental concerns will be a priority for the future development of Montana's coal.

There is potential that new technologies may reduce some of the environmental impacts of coal-fired power. Clean coal-to-liquid technology, which produces both diesel fuel and electric power, while sequestering carbon dioxide and removing pollutants, provides great possibilities to add value to Montana's coal mining industry. Recently, officials and business leaders announced plans to build a $7 billion coal-to-liquids plant within the WIRED region on the Crow Reservation. The plant would produce 50,000 barrels a day of diesel and other fuels. Construction is scheduled to begin in 2012, with production starting in 2016.[21]

Technology also appears to be a limiting factor in the production of biofuels, wind energy, and other non-renewable energy sources. Montana is well-posed to respond to this challenge, as the state was ranked 7th in the nation for renewable electricity generation in 2006 (largely due to hydroelectric generation).[22] Montana has the potential to expand renewable production through biofuels, wind, solar, and geothermal sources.

Biofuels are a natural extension of Montana's agriculture and forestry industries.[23] Despite the future potential for growing our energy, ethanol and biofuels made from agricultural products have received recent criticism for their inefficient energy production and potential impact on world food prices.[24] Further technological improvements will likely address these concerns by improving the production and distribution efficiency of biofuels. Also, further research is needed to explore the use of non-foodstuffs for biofuels productions, such as wood products produced by Montana's forestry industry. With excellent agricultural research facilities and the ability to grow a wide variety of potential fuel sources, Montana has the resources to be at the forefront of research to address the challenges faced by biofuels. Montana currently has three biofuels and biolubricants plants, with another three in the planning and construction phases.[25]

Montana also has great potential to develop wind power as a clean energy source. However, wind energy faces challenges to upgrade technology and infrastructure to moderate day-to-day and seasonal variation in production. Estimated costs of adding wind to an existing transmission system, called wind integration costs, vary from $5 to $13 per megawatt hour.[26] Further, the additional flexible power generation needed to regulate transmissions often uses fossil fuels as an energy source, reducing the 'cleanliness' of wind production. These limitations will surely be improved in the future through technology improvements. For example, smart-grid technologies, which would connect the transmission grid to allow consumers to draw energy from other areas of the country when wind production is low, will likely reduce integration costs and eliminate the need for flexible power generation from nonrenewable sources.

[21] *Brown, Matthew. Crow Coal-to-Liquids Plant Could be Boon for Montana, The Billings Gazette. August 10, 2008.*

[22] *U.S. Department of Energy, Energy Information Administration. See footnote 10.*

[23] *Montana Department of Commerce, Energy Infrastructure Promotion and Development. http://commerce.mt.gov/energy/index.asp.*

[24] *Elam, Thomas E. "Food or Fuel? Choices and Conflicts," Choices, 3rd Quarter, 2008. Vol. 23, N 3.*

[25] *Governor's Office of Economic Development. "Montana's Energy/Resource Developments Under Governor Schweitzer" Available at http://www.business.mt.gov/energyaccomp.asp. Accessed on October 9, 2008.*

[26] *Nowakowski, Sonja. Wind Power Costs and Benefits. 2007-2008 Energy and Telecommunications Interim Committee. January 28, 2008.*

Technology advancements in wind power may address some of the production variability concerns. For example, residential wind power generation uses a type of battery to store power. The challenge is to develop a battery with the storage capacity for commercial power generation. Another developing technology is compressed air energy storage (CAES), which uses wind power to compress air in underground storage areas during off-peak periods. The compressed air is then released and combined with natural gas to produce power during peak periods. CAES can only be utilized in limited geographical areas, including certain locations in Montana, that have underground formations suitable for storing the air. Further, CAES only moderates power production between peak and off-peak periods; it cannot be used to moderate seasonal variation in power generation and transmission.[27]

Regardless of the source of the power, expansion of Montana's energy industry is currently constrained by a lack of transmission infrastructure needed to ship energy products to the customer, particularly to those in the West Coast market. Experts indicate that further development of the energy industry in the state requires greater transmission capacity to bring Montana power to consumer markets.[28]

A number of transmission line projects have been proposed to address the infrastructure deficiency, but most projects have not yet applied for full approval from the appropriate government agencies. The Montana-Alberta Tie, Ltd (MATL), a 215-mile, 300 megawatt transmission line that would connect new wind farms to the existing network in Lethbridge, Alberta and Great Falls, Montana, has been approved and is scheduled to begin construction in Fall 2009.[29]

In addition to MATL, there is a 3,000 megawatt Chinook transmission line proposed by TransCanada that will connect wind and clean-coal electrical plants in Montana to Las Vegas, plus a 500 kilovolt "Mountain States Transmission Intertie" proposed by Northwestern Energy between southwest Montana and Idaho.[30] Smaller transmission lines and updates to existing lines are also planned that will connect distant plants to the main power grid. For example, the Western Area Power Administration is planning to rebuild a 161 kilowatt transmission line from Havre to Great Falls. Another proposal seeks to build a transmission line from Sidney to the middle of the Bakken oil field in Eastern Montana.

The construction of these transmission lines presents opportunities to Montana's workforce. In 2007, 6% of the energy industry was involved in Power and Communication Line construction. This figure likely under-represents the number of individuals involved in utility system construction because some general contractors that are classified under other industries are involved in the building and construction projects. After the completion of the transmission lines, these workers will likely have additional opportunities to construct power plants to utilize the additional transmission capability.

The great potential for expanded energy production in Montana, as well as the constraints the state faces, provide both opportunities and challenges to Montana's energy workforce. Montana's energy industry will need sufficient workers with greater levels of technical skills to meet these challenges and continue industry growth. However, the state faces an additional challenge to energy industry growth in the form of a potential workforce shortage, which will be examined in greater detail in the next section. Montana is developing policies to proactively address these challenges

[27] *Gaelectric Presentation on CAES, Montana State Capitol Building, Helena MT. October 16, 2008. Information sheets and presentation information available at www.gaelectric.ie.*

[28] *Consortium for Electric Reliability Technology Solutions (CERTS), U.S. Department of Energy, Transmission Bottleneck Project Report. March 19, 2003. Nowakowski, Sonja. 2007. Transmission in Montana, Prepared for the Energy and Telecom Interim Committee, Montana State Legislature. Available at http://www.leg.mt.gov/css/Committees/interim/2007_2008/energy_telecom/assigned_studies/transmissionstudypage/transmission.asp.*

[29] *U.S. Department of Energy and Montana Department of Environmental Quality. DOE/EIS-0399. "Federal Draft Environmental Impact Statement and State of Montana Supplemental Draft Environmental Impact Statement for the Montana Alberta Tie Ltd. (MATL) 230-kV Transmission Line." February, 2008. Available at http://www.eh.doe.gov/nepa/docs/deis/eis0399.*

[30] *Montana Department of Commerce, Energy Infrastructure Promotion and Development. Website at http://commerce.mt.gov/energy/index.asp.*

SECTION III:
Workforce Shortages in Montana's Energy Industry

From 2000 to 2006, the energy industry in Montana has increased oil and gas production by 130%, natural gas production by 44%, wind electricity generation by 1,017%, and total electricity generation by 6.8%.[31] The production increase requires more workers within the industry, as well as more workers to build and maintain system infrastructure. With this rapid increase in production, it is not surprising that many in the energy industry have expressed concerns about the availability of appropriately skilled workers.

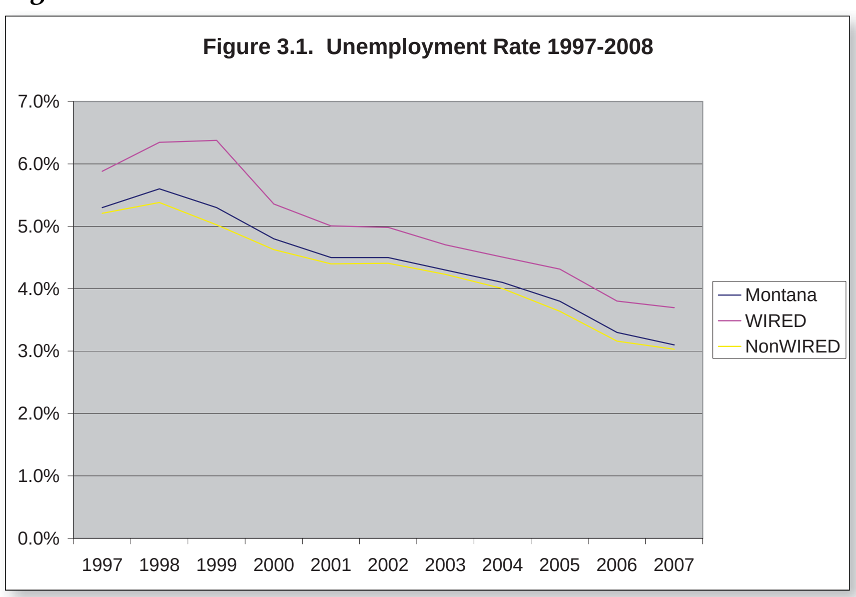
The Montana Department of Labor and Industry does not track data on unfilled job openings. Therefore, it is difficult to 'prove' that businesses are having a hard time finding workers without a costly labor availability and job openings study. However, there are several signs of a labor shortage that can be evaluated using existing data on employment and wages. First, we can check whether the causes of a labor shortage exist, such as low unemployment rates, unexpected rapid job growth, and high competition for workers from other industries. Second, there are also effects of a labor shortage that can be monitored, such as rapidly increasing wages and faster wage growth for entry-level workers than experienced workers.

Signs of a Workforce Shortage, Causes

The most commonly used indicator of a labor shortage is a low unemployment rate. In general, economists look for unemployment rates from four to five percent to indicate a normally functioning labor market. Unemployment rates above five percent can indicate that workers are having difficulty finding employment, while unemployment rates lower than four percent can indicate that businesses are having difficulty finding appropriately trained workers.

Montana's unemployment rate experienced a slow decline from 1998 through 2007, moving from a high of 5.6% in 1998 to a low of 3.1% in 2007. (Figure 3.1). Although the unemployment rate for the WIRED region is only slightly below the 4% level (3.7% in 2007), the low unemployment rate for the full state of Montana indicates that a tight labor market exists. In other words, an examination of the unemployment rate indicates that the potential for a worker shortage exists, although not a severe shortage in the WIRED region.

Figure 3.1



[31] U.S. Department of Energy, Energy Information Administration . See footnote 10.

The difficulty in using the unemployment rate for the WIRED region and the state as a whole is that it provides no indication of industry-specific worker shortages. Perhaps the unemployment rate is low because there is a large demand for workers in the hospitality industry, while the demand for energy workers remains low. However, industry-specific insight can be gleaned from examining industry employment growth.

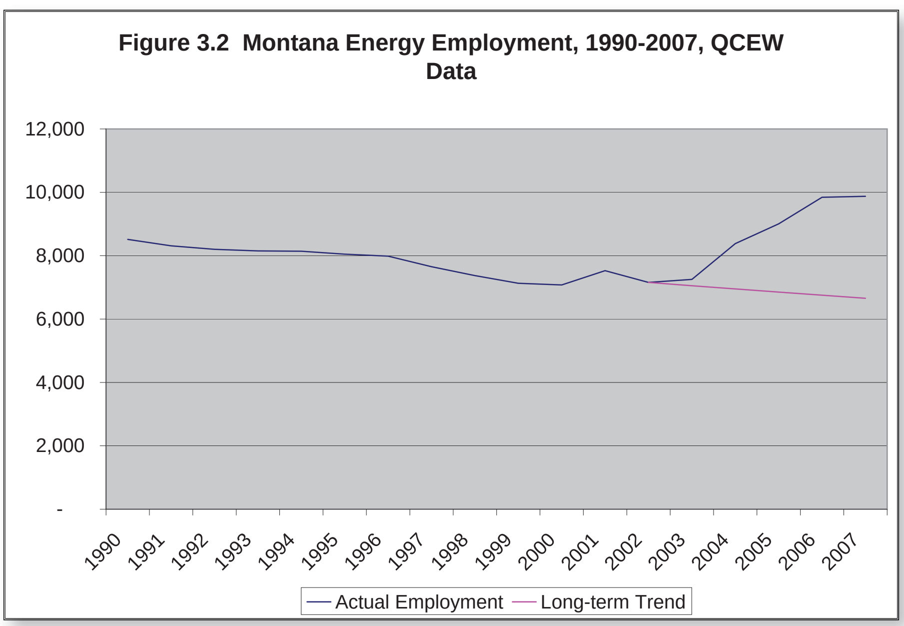
The Montana energy industry has experienced unexpectedly fast employment growth for the past few years. Economists and businesses generally assume that workers consider future employment opportunities in their career and education or training choices, which results in the proper supply of workers to each industry. However, when an industry grows more quickly than expected, there may be a shortage of workers that are adequately trained for the industry, just as there would be an oversupply of labor for industries that grow more slowly than expected.

Figure 3.2 shows that employment growth in the energy industry declined from 1990 to 2003 with a -1.44% per year growth rate. The pink line shows what the level of energy employment would have been if the long-term trend had continued. However, since 2003, the energy industry has grown quite rapidly at a pace of 8% per year. The difference between the actual employment and the 2007 projected employment is 3,200 employees, almost 1/3 of the total energy industry employment for 2007.

This recent, unexpected job growth could indicate a worker shortage. The workforce could not have adequately predicted the ample job opportunities in the energy sector, which may have resulted in insufficient numbers of workers entering the energy industry. On the other hand, the relatively short training time for energy-related jobs likely aids the industry in times of rapid growth.

Another sign of a worker shortage is high competition for workers from other industries. For example, construction and extraction workers comprise over 27% of the energy workforce (shown in Figure 2.4). However, the energy industry is not the largest employer of these types of workers. Of the total 32,460 construction and extraction workers in Montana, only 8.3% work within the energy industry. In comparison, the construction industry (minus utility system construction) employs 64.9% of construction and extraction workers. Therefore, the workforce needs of the construction industry significantly influence the availability of construction and extraction workers for the energy industry.

Figure 3.2



The construction industry has been one of the most rapidly growing industries in the past few years, with 7% annual compounding growth in employment over the 2000-2007 period, compared to 2% for all industries in Montana. However, as the national housing market difficulties affect Montana's construction industry, the energy industry may see less competition for workers.

As we have seen, all three market conditions known to be causes of workforce shortages existed during the 2005-2007 period in Montana.

Signs of a Workforce Shortage, Effects

Businesses that are having trouble filling positions often bid up wages to attract qualified workers, resulting in rapid wage increases. From 2000 to 2007, wages in the energy industry increased at a faster rate than wages in all industries in Montana, growing at an annual compounding rate of 4.3% compared to the overall growth rate of 4.1%. Over the same period, wage growth in the energy industry outpaced employment growth, with annual compounding growth rates of 4.3% and 3.7%, respectively.[32]

Rapid wage growth alone is not conclusive; wage increases can also be caused by labor productivity increases. Economic theory indicates that in a normally functioning labor market, wages are paid according to the productivity of the worker. Thus, if productivity increases, wages will also increase. Figures 3.3 through 3.5 compare wage increases with productivity increases in the oil and gas, coal, and electricity industries. If wages in the energy industry were increasing in response to productivity increases, there would be a positive correlation between productivity and wages. However, there is not a strong relationship between productivity and wages, and this relationship varies by each energy sector.

For example, Figure 3.3 compares the production of oil and natural gas per worker to the average wage in the oil and gas mining industry. During 2001-2003, productivity increased dramatically with a 22.1% annual increase for 2002 and a 28.7% increase in 2003. The average wage per worker, however, decreased during these two years, and increased in years where productivity growth was negative.

A similar wage-productivity relationship can be seen in the coal industry (Figure 3.4). Again, there does not appear to be a relationship between productivity increases and wage increases. The largest productivity increase occurred in 2004, which was the only year to see negative wage growth. Further, 2003 saw the largest recent increase in wages (12.0%), while productivity increases for the same year were only modest, at 2.9%.

In fact, the correlation between the production per worker and average wage was negative for the oil and gas industry (-0.24) and the coal industry (-0.52), which is opposite of the sign expected. The negative correlation disappears when calculated on a quarterly basis, but the correlation remains close to zero.[33] The low correlation between productivity and wage increases in the energy mining sectors seems to indicate that wage increases were due to factors other than productivity increases.

The lack of correlation between productivity and wages seems only to extend to certain sectors in the energy industry. Figure 3.5 shows the productivity and wages for the production of electricity in Montana using employment in NAICS industry 2211 – Electric Power Generation, Transmission, and Distribution. This industry demonstrated a very strong relationship between productivity and wages, with a correlation of (0.90).

It is not completely clear why the utility industry differs from the mining of oil and gas, but it suggests that wage increases due to worker shortages vary between the different sectors within the energy industry. The Electrical Power Generation, Transmission, and Distribution sector was one of only two energy sectors with declining employment during the 2000 to 2007 period (Figure 2.3). Further, the increases in energy productivity may be due to factors other than increased labor productivity. For example, increases in oil and natural gas production may be due to higher-producing horizontal wells or newer wells. Productivity increases due to factors other than labor would not result in wage increases.

[32]U.S. Department of Labor, Bureau of Labor Statistics. Quarterly Census of Employment and Wages. 2000-2007.

[33]Quarterly calculations of productivity and wage correlations are difficult because of the large increase in wages during the fourth quarter due to end-of-the-year bonuses. This calculation of quarterly correlation only used wages and productivity for the first three quarters of each year, which eliminates the problem of an abnormal quarter, but also removes the portion of pay that is most closely related to productivity, as bonuses are often awarded based on the increases in productivity shown by the workers during the year and the resulting profitability of the business.

Figure 3.3

Productivity and Wage Increases in Montana's Oil and Gas Industry

	MMcf Natural Gas	Thousand Bbls Oil	Employment	Production Per Worker	Average Wage	Increase in Productivity	Increase in Wages
2001	81,944	16,288	490	200.5	$55,495		
2002	86,762	16,990	424	244.7	$55,046	22.1%	-0.8%
2003	86,750	19,420	337	315.0	$51,369	28.7%	-6.7%
2004	98,137	24,718	467	263.1	$60,498	-16.5%	17.8%
2005	108,617	32,786	548	258.0	$62,247	-1.9%	2.9%
2006	114,080	36,250	607	247.7	$74,012	-4.0%	18.9%
2007	120,765	34,858	640	243.2	$75,954	-1.8%	2.6%

Source: Montana Online Oil and Gas Information System, Montana Board of Oil and Gas. Quarterly Census of Employment and Wages, NAICS code 2111.

Figure 3.4

Productivity and Wage Increases in Montana's Coal Industry

	Production	Labor Hours	Production per Labor Hour	Average Wage	Increase in Productivity	Increase in Wages
2001	39,142,820	1,653,767	23.7	$56,671		
2002	37,385,807	1,596,021	23.4	$58,785	-1.0%	3.7%
2003	36,994,098	1,534,962	24.1	$65,835	2.9%	12.0%
2004	39,988,503	1,554,839	25.7	$60,514	6.7%	-8.1%
2005	40,353,984	1,735,273	23.3	$62,181	-9.6%	2.8%
2006	41,822,805	1,902,485	22.0	$66,424	-5.5%	6.8%
2007	43,389,833	1,954,345	22.2	$69,370	1.0%	4.4%

Source: Coal Production Data Files, Energy Information Administration, U.S. Department of Energy. Quarterly Census of Employment and Wages, NAICS code 2121.

Figure 3.5

Productivity and Wage Increases in Montana's Electrical Power Generation, Transmission, and Distribution Industry

	Megawatthours	Employment	Total Energy Industry Wages	Production Per Worker	Increase in Productivity	Increase in Wages
2000	26,451,828	2,799	$54,980	9,450.5		
2001	24,232,485	2,700	$56,807	8,975.0	-5.0%	3.3%
2002	25,473,705	2,450	$61,385	10,397.4	15.8%	8.1%
2003	26,268,727	2,352	$64,975	11,168.7	7.4%	5.8%
2004	26,788,768	2,290	$63,033	11,698.2	4.7%	-3.0%
2005	27,938,778	2,313	$65,900	12,079.0	3.3%	4.5%
2006	28,243,536	2,379	$69,878	11,872.0	-1.7%	6.0%

Source: Energy Information System, U.S. Department of Energy. Quarterly Census of Employment and Wages, NAICS 2211.

Figure 3.6

Wage Growth for Entry vs. Experienced Workers in the Energy Industry in Montana

	Employment	Entry Wage	Experienced Wage
2002	7,518	25,439	56,936
2007	9,854	28,382	61,092
5-year Growth	31.1%	11.6%	7.3%

Source: Occupational Employment Statistics, 2007

The differences in the labor productivity and wage relationship between different energy sectors may also suggest that a shortage may only exist for workers with specific skill sets. For example, Construction and Extraction workers, who are in short supply because of rapid growth in the construction industry, comprise of only 2% of the Electric Generation and Distribution industry. Instead, the electric utility industry employs Installation, Maintenance, and Repair workers, which have not been in such high demand during the 2002-2007 timeframe. Competition from other industries may be driving wage growth only for certain types of energy workers.

Another effect of a labor shortage is faster wage growth for entry level workers compared to experienced workers. Companies fill positions requiring experience from within their own company, but have to out-bid other companies to obtain workers for the entry-level jobs. During the 2002 to 2007 time frame, the wage growth for entry-level and experienced workers in the energy industry was quite different. Wages for entry-level jobs increased by 11.6%, while the experienced wage increased by only 7.3% (Figure 3.6), suggesting tight labor market conditions in the energy industry.

Although workforce shortages are difficult to prove, there are many indications that the energy industry is having a hard time finding appropriately skilled workers. The unemployment rate was comparatively low, the energy industry experienced unexpected job growth, and other industries that compete with the energy industry for workers also experienced rapid growth – all of which are potential causes of a workforce shortage. The effects of a worker shortage are also evident in the energy industry – the average wage is higher and growing faster than the average wage for the state as a whole, and the wage growth does not appear to be caused by productivity increases. Also, the wage for entry-level workers in the energy industry grew at a faster rate than wages for experienced workers, a sign of businesses trying to compete for new workers. All of these signs point to the conclusion that a workforce shortage exists in Montana's energy industry.

Occupations Most in Demand

To effectively deal with workforce shortage issues, we must first determine which occupations are most in demand. To identify these occupations, we can use the same indicators used previously to determine that a workforce shortage exists. These indicators are:

1. Low unemployment rates
2. Rapid job growth
3. High competition for workers from other industries
4. Rapidly increasing wages, and
5. Faster wage growth for entry-level workers than experienced workers

The energy industry includes employment in 173 occupations. To determine which occupations are most in demand, we used a process of elimination, removing those occupations that did not display the signs of a workforce shortage in the energy industry. Specifically, occupations were removed when the following occurred:

1. Employment decreased during the 2002 to 2007 period within the energy industry;
2. The wage in the energy industry was less than the wage in other industries, indicating that the energy industry was not competing for workers with other industries;
3. Wage growth during the 2002 to 2007 period was negative (the mean wage in 2002 was higher than the mean wage in 2007), which would indicate that the energy industry did not experience the need to bid up wages to attract and retain workers; and
4. Employment in the occupation was less than 10 or could not be published for reasons regarding disclosure or estimation consistency.

After removing occupations that met these criteria, 48 remained. These occupations were then examined for the relationship between entry-level wage growth and wage growth for experienced workers.

The relationship between entry-level and experienced wage growth can be fairly nuanced at the occupation level. Workforce shortages have two aspects – a shortage of workers and a shortage of skills. High growth in the wages for entry-level workers indicate that an industry is attempting to recruit more workers to combat a worker shortage. However, rapidly growing wages for experienced workers with falling wages for entry-level workers may indicate that an industry is attempting to retain highly skilled workers – a skill shortage.

Of the 48 remaining occupations, five were identified as having entry-level wage growth that was much faster than the wage growth for experienced workers over the 2002 to 2007 time period. Occupations with entry-level wage growth over two times faster than experienced level wage growth are shown in Figure 3.7.

The largest of these occupations is Laborers and Freight Movers with 276 workers in the energy industry in 2007. The entry-level wage for Laborers and Freight Movers grew at a compounding annual rate of 8.3% from 2002-2007, compared to 4.1% for experienced workers.

Figure 3.7

Occupations with Entry-Level Wage Growth Over Two Times Faster than Experienced Level Wage Growth

		2007 Energy Employment	Compound Annual Growth		Education and Training Category
			Entry	Experienced	
17-3023	Electrical and Electronic Engineering Technicians	117	7.9%	2.8%	Associate degree
49-9041	Industrial Machinery Mechanics	173	13.0%	5.3%	Long-term on-the-job training
51-4121	Welders, Cutters, Solderers, and Brazers	144	4.9%	2.4%	Postsecondary vocational training
51-8013	Power Plant Operators*	65*	13.3%*	5.5%*	Long-term on-the-job training
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	276	8.3%	4.1%	Short-term on-the-job training

**Employment and wage data for Power Plant Operators includes all industries, not just the energy industry. because of confidentiality concerns. Although data to verify this statement is not publicly available, it seems reasonable that the energy industry would be a significant employer of Power Plant Operators and would therefore have wage patterns similar to those found in all industries.*

The occupations in Figure 3.7 display signs of a worker shortage, but this shortage appears limited to the energy industry. With the exception of Power Plant Operators (where energy likely dominates the labor demand), the wage growth for entry level workers in all industries over the same time period follows the normal pattern of a properly functioning labor market, where entry level wage growth is similar to or less than the wage growth for experienced workers.

In contrast to the occupations in Figure 3.7, which exhibit signs of a worker shortage, Figure 3.8 shows occupations that exhibit signs of a skill shortage. The skill-shortage occupations had strong wage growth for experienced workers, but comparatively low wage growth for entry-level workers.

Specifically, the occupations in Figure 3.8 either had negative entry level wage growth with high positive experienced-level wage growth, or had experienced-level wage growth over five times the wage growth for entry level workers. For example, the entry level wage for First-line Supervisors of Production and Operations Workers decreased at an annual compounding rate of -4.6%, but the experienced wage increased by 2.3% annually. The large difference between the entry-level wage and experienced-level wage indicates that there is strong demand for a high level of skills in this occupation, but not a strong demand for people to fill openings.

Some of the occupations in Figure 3.8 may be experiencing an over-supply of labor in a declining occupation, which would result in below-average wage growth. For example, the average wage for Executive Secretaries and Administrative Assistants in the energy industry grew at an annual rate of 0.7%, compared to a rate of 3.2% in all industries. This low wage growth indicates that the energy industry may have an over-supply of workers in this occupation, and is only retaining those with high levels of experience and skills.

Slower wage growth in the energy industry compared to all industries does not automatically mean that the occupation is declining within the energy industry. In some occupations, such as Electrical Repairers for Powerhouse, Substation, and Relay Stations, the labor demand is dominated by the energy industry. Wages for these occupations will not increase as quickly because of lower competition from other industries. Further, slow wage growth overall may simply mean that these occupations are not experiencing a worker shortage, which would drive overall wage growth, but are experiencing a skill shortage, which drives wage growth only for experienced workers.

There are also two occupations that exhibit signs of a worker shortage by having wage growth that is over twice that of the average in the energy industry. These occupations are Rotary Drill Operators and Cost Estimators, both of which experienced compounding wage growth of over 9% during the 2002-2007 time frame (compared to 2.6% for all occupations). There were 247 Rotary Drill Operators employed in the energy industry during 2007, and the occupation requires moderate-term on-the-job training. Cost Estimators require a Bachelor's degree.

Figure 3.8

Occupations with Fast Experienced Wage Growth in Comparison to Entry Level Wage Growth

					Overall Wage	
		2007 Employment	Entry Wage Growth	Experienced Wage Growth	Energy	All
15-1071	Network and Computer Systems Administrators	31	-0.6%	4.2%	3.1%	2.8%
43-5032	Dispatchers, Except Police, Fire, and Ambulance	94	0.4%	7.0%	5.4%	5.3%
43-6011	Executive Secretaries and Administrative Assistants	136	-0.4%	1.0%	0.7%	3.2%
47-5081	Helpers--Extraction Workers	64	0.3%	5.6%	4.3%	5.1%
47-5099	Extraction Workers, All Other	26	0.1%	1.2%	0.9%	-1.8%
49-1011	First-Line Supervisors/ Managers of Mechanics, Installers, and Repairers	261	-0.3%	3.1%	2.3%	4.1%
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	49	0.3%	1.5%	1.1%	1.2%
49-3023	Automotive Service Technicians and Mechanics	27	-2.4%	3.0%	1.9%	3.8%
51-1011	First-Line Supervisors/ Managers of Production and Operating Workers	93	-4.6%	2.3%	0.6%	4.3%
53-3032	Truck Drivers, Heavy and Tractor-Trailer	388	-0.5%	6.4%	4.7%	2.2%
53-7073	Wellhead Pumpers	229	0.2%	4.9%	3.7%	3.6%
	Weighted Average for All Occupations		2.4%	2.8%	2.6%	

Figure 3.9 shows all of the occupations that have been identified for possible workforce shortages, along with the estimated 2007 employment level, the 2007 average wage, and the education and training generally required to fill the occupation. The chart also includes four columns that present the most recent projections for job growth in these occupations. Because these projections are based on data through 2007 and do not include the changes in the economy that occurred in 2008, the employment needs are likely overstated.

The first projections column shows the projected annual job growth expected in energy-related industries.[35] The following three columns present the projected annual job growth, annual turnover, and total annual openings (from both growth and turnover) for each occupation across all Montana industries. For example, the projections indicate that 92 new Truck Driver jobs will be created in Montana every year, but only 41 of these jobs will be created in the energy industry. Truck Drivers have high

[34]*Occupational projections are only available at the 3-digit industry level. Therefore, this estimate does not utilize the definition of energy industry used throughout the rest of the paper that is based off 4-digit NAICS codes. This estimate includes the NAICS codes of 211, 212, 213, 221, 237, 324, 424, 486, and 562.*

Figure 3.9

Energy Occupations Showing Signs of a Worker Shortage with Projected Worker Needs, 2006-2016 Projections

		Current Data			Projected Data			
						All Industries		
Code	Occupation	2007 Energy Jobs	2007 Avg. Wage, Energy	Required Education Level	Energy Ind. Projected Annual Growth	Annual Job Growth	Annual Turnover	Total Annual Openings
13-1051	Cost Estimators	20	77,220	BD	<5	25	15	40
15-1071	Network and Computer Systems Administrators	30	65,260	BD	<5	19	15	34
17-3023	Electrical and Electronic Engineering Technicians	120	64,020	AD	0	<5	<10	12
43-5032	Dispatchers, Except Police, Fire, and Ambulance	90	45,910	MT-OTJ	0	<10	19	25
43-6011	Executive Secretaries and Administrative Assistants	140	35,140	WE	<5	130	98	228
47-5012	Rotary Drill Operators, Oil and Gas	250	51,950	MT-OTJ	14	14	<5	17
47-5081	Helpers--Extraction Workers	*	35,820	ST-OTJ	<5	<10	<5	<10
47-5099	Extraction Workers, All Other	*	*	MT-OTJ	<5	<5	<5	<10
49-1011	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers	260	66,070	WE	<5	22	35	57
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	50	57,230	PVT	0	0	<5	<5
49-3023	Automotive Service Technicians and Mechanics	30	45,150	PVT	<5	77	70	147
49-9041	Industrial Machinery Mechanics	170	56,240	LT-OTJ	<10	12	11	23
51-1011	First-Line Supervisors/Managers of Production and Operating Workers	90	68,630	WE	<5	11	20	31
51-4121	Welders, Cutters, Solderers, and Brazers	140	51,580	PVT	<10	35	29	64
51-8013	Power Plant Operators	*	*	LT-OTJ	<5	<5	<5	<5
53-3032	Truck Drivers, Heavy and Tractor-Trailer	390	36,210	MT-OTJ	41	92	126	218
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	280	31,540	ST-OTJ	<10	58	143	201
53-7073	Wellhead Pumpers	*	43,370	MT-OTJ	*	*	*	*

BD = Bachelor's Degree, AD = Associate's Degree, PVT = Post-secondary Vocational Training, WE = Work Experience in a Related Occupation, ST-OJT = Short-Term On-the-Job Training, MT-OJT = Moderate-Term On-the-Job Training, LT-OJT = Long-Term On-the-Job Training

Note: Some occupations suppressed due to confidentiality. Occupations with projections of less than 10 were categorized into categories of <5 or <10 due to high standard errors in occupational projections by industry.

Source: 2006-2016 Projections, Research and Analysis Bureau, Montana Department of Labor and Industry, Bureau of Labor Statistics. With Occupational Employment Statistics, 2007.

turnover, and 126 Truck Driver jobs will be open every year due to turnover. An estimated 218 Truck Driver positions will need to be filled every year.

Although these occupations have been identified as experiencing workforce shortages, the projections indicate that some of them have low demand for new workers. For example, new job creation for Electrical Powerhouse Repairers is not expected, and turnover is expected to be less than five positions per year. The job opportunities for Electrical Powerhouse Repairers are not expected to be plentiful. On the other hand, Executive Secretaries, Truck Drivers, Hand Laborers, and Automotive Service Technicians, are expected to have over 100 openings every year. These occupations appear to be better candidates for job training programs to address the workforce shortages in the energy industry.

SECTION IV: Evaluation of Options to Address Workforce Shortages

In order for businesses and government to effectively address a workforce shortage, it is important to first determine the nature of the shortage. We have already discussed how workforce shortages can be caused by a shortage of people to fill the open positions, or by a shortage of workers with the appropriate skills. However, among certain industries, there may be a third cause: the fluctuating nature of the industry. In a cyclical industry such as energy, there are periods of both increased and decreased employment opportunities. The transition period between the two may be months or years. The challenge is to find available workers who are capable of being trained quickly or who already possess the appropriate skills.

Whether the current workforce shortage is cyclical in nature is an important consideration in the evaluation of policy options. If the shortage is cyclical and temporary, the temptation is to adopt a laissez-faire policy and allow the labor market to self-correct. For example, the slowdown in the construction and mining industries during 2008 will likely alleviate workforce shortage concerns for the energy industry. On the other hand, the current economic slowdown will hopefully be temporary. If job growth in the energy and construction industries is expected to regain its pre-recession growth, workforce shortages could persist for long periods and inhibit growth in these industries. Action may be needed to encourage more workers to seek employment in the energy industry.

There is also an issue of primary responsibility for addressing workforce shortages. The relative importance of on-the-job training and work experience, compared to formal education programs, for Montana energy jobs suggests that businesses need to take a leadership role in providing worker training. However, governments may also be interested in facilitating worker training in the interest of economic development. Further, if government regulations cause additional worker training requirements, as indicated by the following quote from Deseren & Tobin, government is justified in providing worker training to compensate for those requirements:

> ***[In] terms of technological and organizational changes in processing activities, respondents frequently spoke in terms of licensing requirements, certification, increased demand for technological skills, safety training programs, and compliance with environmental laws. Clearly, companies were finding it increasingly difficult to comply with various regulations and associated paperwork.***[36]

More oversight instituted by government agencies likely increases the time needed to train new workers or upgrade the skills and knowledge of previously employed workers. The longer training time can hamper industries that need to respond rapidly to changes in demand, especially if the upswings are limited in duration. Weeks lost in training new employees may very well represent significant losses in revenues. The intense need for quickly acquiring employees that can "hit the ground running" may lead recruiters to look within the industry for new personnel, which does not address workforce shortages at the industry level.

Assuming that both businesses and government decide to take action to alleviate workforce shortages, there are two possible courses of action: adopt new technologies to automate aspects of the production process, or to acquire new workers from other businesses within the industry, from other industries, or from outside the labor force.

[35]*Deseran, F. A. & Tobin, L. (2003) Labor Demand in the Offshore Oil and Gas Industry in the 1990's: The Louisiana Case, U.S. Department of the Interior, Minerals Management Service*

New Technologies

Upgrading business equipment can make the production process more automated and less labor intensive. Although a number of tax provisions exist to encourage businesses to upgrade equipment, the upgrade process often remains costly. Further, the cyclical nature of the oil and gas mining industry make it difficult to time equipment upgrades effectively. Upgrades would be most effective when done at the start of an upswing in the business cycle, so that costs are spread over the full cycle. Yet this is also the same time when companies would be hiring more workers to ramp up production, which creates the illusion that equipment upgrades do not alleviate labor concerns. As Deseran and Tobin report:

> ***[Only] one company indicated that technology was driving down demand for labor (doing same amount of work with half as many people), yet this same company had increased the number of employees overall, and was finding it difficult to get enough qualified workers.***[37]

The increases in the productivity per worker in the Montana energy industry over the past few years indicate that energy businesses may be upgrading equipment for more productive technologies, although it is unclear what types of upgrades are being made. There is some indication that upgrades or other changes in the production process have shifted the focus to lower-skilled labor. In 2002, 20% of jobs in the energy industry required education and experience at a bachelor's degree or higher, compared to 15% of jobs requiring this level of education in 2007. The percentage of jobs requiring moderate-term on-the-job training has increased dramatically, moving from 29% in 2002 to 39% in 2007. The trend of the last five years has been to move toward workers with on-the-job training, rather than formal education.

Finding New Workers

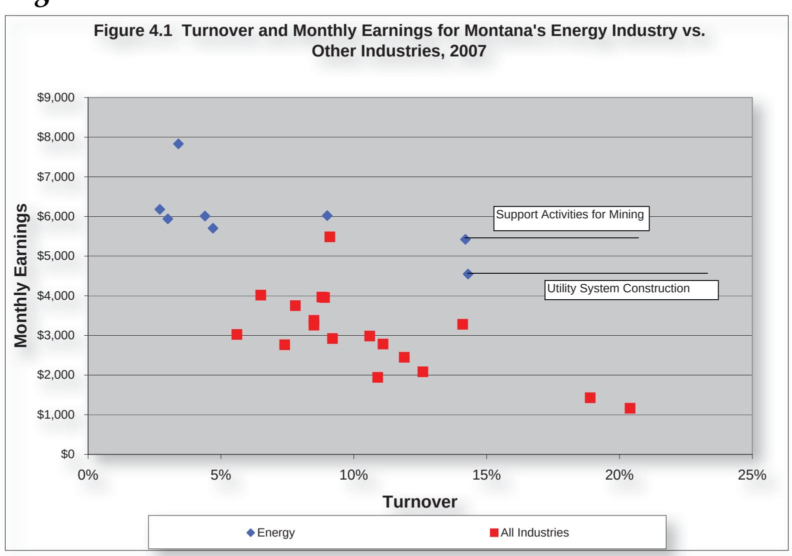
The other option for businesses faced with a workforce shortage is to find new workers. The most expedient option is to find workers from other businesses, industries, or occupations that already have the necessary skills for the job. However, during periods of workforce shortages, businesses may need to find workers from outside the labor force and provide training.

Workers from within the Energy Industry and Turnover

Training new workers is costly, so it is only natural that businesses attept to hire experienced workers from other businesses within the industry by offering better working conditions, or better compensation and benefits. While recruiting workers from within the industry may meet immediate labor needs, it does not address the worker shortage at the industry level.

Figure 4.1 plots each of Montana's industry sectors by the turnover (horizontal axis) and average wages (vertical axis). The relationship between monthly earnings and turnover rates is clear, with low-paying industries experiencing higher turnover rates.

Figure 4.1



Source: U.S. Census Bureau, Center for Economic Studies, Quarterly Workforce Indicators

[36]See Footnote 35

Each sub-sector of the energy industry is also plotted on the chart with blue dots. For the most part, the energy industry has turnover rates that are lower than other industries in Montana, which is expected because of the higher wages in the industry. However, three sectors of the energy industry have higher turnover rates than would be expected, given their wages. At monthly wages of $4,500 and $5,400, respectively, utility system construction and support activities for mining would be expected to have turnover rates at about 5% based on the trend from non-energy industries. However, both sectors have turnover rates above 14%. Further, the oil and gas extraction sector has an average monthly wage of $6,000. At this wage, the expected turnover rate should be lower than 5%, yet the turnover rate is 9%.

The higher than expected turnover in these energy sectors may be a result of the more dangerous work or a less pleasant work environment. However, it may also indicate that energy businesses are recruiting workers from other businesses within the industry to help meet labor demands. This practice may benefit individual businesses, but high turnover raises recruitment and training costs for the industry as a whole.

The industry must address long-term workforce needs through the recruitment and training of workers from outside the industry in order to increase the overall supply of industry workers. The new workers may come from declining industries, occupations with similar skills, or even from outside the workforce. However, all of the new workers will likely require training to meet the demands of their new jobs in the energy industry.

Competition Between Industries for Similarly-Skilled Workers

Businesses often recruit workers from related industries who possess the same or similar (transferable) skills. Ideally, these workers would come from industries experiencing declining employment with an excess of labor. However, there are few industries that have experienced declining employment during the 2002-2007 timeframe.

Figure 4.2 illustrates which sectors employ workers with similar skills to those required in the energy industry, as well as indicating the sector's growth over the past five years. The top row shows the percentage of the energy workforce employed within each occupational group. For example, 27% of the energy workforce works in Construction and Extraction Occupations. Energy businesses looking to fill construction and extraction jobs would do well to recruit from the mining, construction, and public administration industries. The construction industry employs 71% of workers in Construction and Extraction Oc-

Figure 4.2

Sectors that Employ Similarly-Skilled Workers, Percent of Occupation Employed by Industry	% Growth, 2002-2007	Construction & Extraction Occupations	Installation, Maintenance, & Repair Occupations	Transportation & Material Moving Occupations	Office & Administrative Support Occupations
Percent in Energy Industry		27%	17%	13%	13%
Agriculture	-23%				
Mining	46%	10%		5%	
Utilities	6%		5%		
Construction	37%	71%	7%	5%	5%
Manufacturing	4%		6%	7%	
Wholesale Trade	10%		9%	13%	6%
Retail Trade	7%		20%	16%	14%
Transportation and Warehousing	27%		8%	28%	7%
Information	-2%		5%		
Finance	8%				14%
Real Estate	20%				
Professional Services	16%				8%
Management	1%				
Administrative and Support Services	27%				7%
Education	76%				6%
Health Care	12%				13%
Arts, Entertainment, and Recreation	32%				
Accommodation	7%			5%	
Other Services	5%		13%		5%
Public Administration	3%	7%	10%		

Source: Occupational Employment Statistics, 2007

cupations in Montana, while Mining employs 10%, and Public Administration employs 7%.[38]

However, both mining and construction experienced fast employment growth over the 2002-2007 period. Perhaps the energy industry would have the greatest success in recruiting Construction and Extraction workers from the public administration sector because of lower labor demand in this slow-growing industry. The economic slowdown that started to impact employment growth during 2008 may result in greater labor availability across all industries, but particularly in construction.

There are some occupations that are exclusive to the energy industry and cannot be recruited from other industries. Figure 4.3 shows 11 occupations that are predominantly energy jobs, or where over 80% of the employment for the occupation works within the energy industry. For example, 90% of Montana's petroleum engineers work in the energy industry.

Obtaining Workers from Outside the Labor Force

In Montana, about 65% of the population 16 years and older participates in the labor force.[39] The remainder of the population may be a good source of new workers to the energy industry. In general, workers who have attained less than a high school diploma, who are minorities, who are older than 55 or younger than 24, who are ex-offenders, or who are women, tend to have lower labor force participation.[40]

Figure 4.3

Occupations where More than 80% of the Employment Works in the Energy Industry

Occupation Code	Occupation Name	2007 Employment in the Energy Industry	Average Annual New Jobs, 2002-2007	% of Occupational Employment within the Energy Industry
17-2171	Petroleum Engineers	68	11	90%
47-5011	Derrick Operators, Oil and Gas	494	85	100%
47-5012	Rotary Drill Operators, Oil and Gas	247	36	99%
47-5013	Service Unit Operators, Oil, Gas, and Mining	112	13	100%
47-5042	Mine Cutting and Channeling Machine Operators	*	*	89%
47-5071	Roustabouts, Oil and Gas	313	52	96%
49-9051	Electrical Power-Line Installers and Repairers	656	38	90%
51-8013	Power Plant Operators	*	*	97%
51-8092	Gas Plant Operators	*	*	85%
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	358	-29	97%
53-7071	Gas Compressor and Gas Pumping Station Operators	*	*	100%
53-7073	Wellhead Pumpers	*	*	98%
53-7111	Shuttle Car Operators	*	*	100%

**Suppressed for confidentiality.*
Source: Occupational Employment Statistics, Bureau of Labor Statistics

[37]The definition of the energy industry used throughout this report is a compilation of workers from many industries. Some of the 71% construction and extraction workers employed in the construction industry may be employed in utility system construction, which is included in the energy industry definition.

[38]The labor force is defined as those who are working or currently looking for employment. 2005-2007 ACS, US Census Bureau.

[39]Turner, Tyler and Eldredge, Brad. "Help Wanted: A Look at Labor Force Participation in Montana" Economy at a Glance. Research and Analysis Bureau, Montana Department of Labor and Industry. March 2007.

However, people have various reasons for not participating in the labor force, and recruiting them as workers may require businesses to offer different benefits or additional training to address these reasons. For example, many older workers and women are well-trained, but have left the labor force for reasons related to a life-work balance. These workers may be willing to rejoin the workforce if flexible scheduling or child care services were offered. Younger workers, workers without a high school diploma, or ex-offenders likely do not meet the education and training requirements for energy industry jobs, so these workers must be aided with training programs.

Required Training Programs

The majority of energy industry jobs require short-term on-the-job training or related work experience, rather than formal education programs. This distribution can also be expected in the future, as the trend over the last five years has been toward lower-skill workers. Because the primary need is practical work experience and on-the-job training, businesses or worker unions are likely in the best position to take primary responsibility for the training.

Even if a worker has previous work experience or a formal education that qualifies them for a position, the worker will likely need some on-the-job training specific to the company. Only 6% of energy jobs can be performed with no training or a short demonstration. These jobs are shown in Figure 4.4. However, on-the-job training does not need to be extensive in duration; only 26% of energy jobs require on-the-job training lasting over one year.

Only 20% of jobs in the energy industry require formal education. Figure 4.5 shows the top ten occupations in the energy industry that require formal education programs. Some occupations in Figure 4.5 are fairly general with skills that are not specific to the energy industry, such as accountants and property managers. However, welders and related workers, petroleum engineers, and

Figure 4.4

Occupations in the Energy Industry Requiring Less than 3 Months Work Experience	
Compliance Officers, Except Agriculture, Construction, Health and Safety, and Transportation	Helpers--Carpenters
Operations Research Analysts	Hazardous Materials Removal Workers
Environmental Engineering Technicians	Roustabouts, Oil and Gas
Title Examiners, Abstractors, and Searchers	Telecommunications Line Installers and Repairers
Landscaping and Groundskeeping Workers	Water and Liquid Waste Treatment Plant and System Operators
Tree Trimmers and Pruners	Chemical Equipment Operators and Tenders
Cashiers	Mixing and Blending Machine Setters, Operators, and Tenders
Real Estate Sales Agents	Inspectors, Testers, Sorters, Samplers, and Weighers
Meter Readers, Utilities	Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders
Shipping, Receiving, and Traffic Clerks	Driver/Sales Workers
Stock Clerks and Order Fillers	Truck Drivers, Light or Delivery Services
Insulation Workers, Mechanical	Loading Machine Operators, Underground Mining
Pipelayers	Industrial Truck and Tractor Operators
Reinforcing Iron and Rebar Workers	Laborers and Freight, Stock, and Material Movers, Hand
Pump Operators, Except Wellhead Pumpers	Gas Compressor and Gas Pumping Station Operators

*Source: Occupational Employment Statistics, 2007. O*Net Occupational Information*

Figure 4.5

Top Ten Occupations in the Energy Industry that Require Formal Education			
		2007 Employment (Rounded)	Education Required
1	Property, Real Estate, and Community Association Managers	*	Bachelor's degree
2	General and Operations Managers	300	Bachelor's or higher, plus work experience
3	Accountants and Auditors	110	Bachelor's degree
4	Computer Systems Analysts	90	Bachelor's degree
5	Electrical Engineers	60	Bachelor's degree
6	Petroleum Engineers	70	Bachelor's degree
7	Electrical and Electronic Engineering Technicians	120	Associate degree
8	Geoscientists, Except Hydrologists and Geographers	70	Master's degree
9	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	50	Postsecondary vocational training
10	Bus and Truck Mechanics and Diesel Engine Specialists	60	Postsecondary vocational training

**Suppressed for confidentiality.*
Source: Occupational Employment Statistics, 2007.

geoscientists are fairly specific to the energy industry. Only 5% of jobs in the energy industry need an associate degree or vocational training. This education and training category has grown since 2002 when only 4% of jobs required this level of training. Figure 4.6 shows the occupations within the energy industry that require an associate degree or vocational training. Many of the occupations have the employment suppressed due to a low number of jobs.

In summary, those concerned about the workforce shortage in the energy industry can take action by either improving business technologies to alleviate unmet labor needs or by finding and training employees from outside the energy industry. Policy makers and educators attempting to assist businesses in training energy workers should keep in mind the strong focus on on-the-job training when developing curriculums.

Figure 4.6

Occupations in the Energy Industry Requiring an Associate Degree or Postsecondary Vocational Training		
		2007 Energy Employment (Rounded)
Associates Degree	Computer Support Specialists	*
Associates Degree	Civil Engineering Technicians	*
Associates Degree	Electrical and Electronic Engineering Technicians	117
Associates Degree	Environmental Engineering Technicians	*
Associates Degree	Mechanical Engineering Technicians	*
Associates Degree	Engineering Technicians, Except Drafters, All Other	*
Associates Degree	Chemical Technicians	*
Associates Degree	Geological and Petroleum Technicians	32
Associates Degree	Environmental Science and Protection Technicians, Including Health	*
Postsecondary Vocational Training	Electrical and Electronics Drafters	*
Postsecondary Vocational Training	Mechanical Drafters	*
Postsecondary Vocational Training	Drafters, All Other	*
Postsecondary Vocational Training	Real Estate Sales Agents	*
Postsecondary Vocational Training	Electrical and Electronics Repairers, Commercial and Industrial Equipment	*
Postsecondary Vocational Training	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	49
Postsecondary Vocational Training	Automotive Service Technicians and Mechanics	27
Postsecondary Vocational Training	Bus and Truck Mechanics and Diesel Engine Specialists	58
Postsecondary Vocational Training	Welders, Cutters, Solderers, and Brazers	144

**Suppressed for confidentiality.*
Source: Occupational Employment Statistics, 2007

Conclusion

During the last five years, Montana's energy industry has shown signs of a workforce shortage, including rapidly growing wages and employment, higher growth for entry-level wages compared to experienced wages, and high competition from other industries for workers. All of these signs are the result of strong growth in the energy industry and strong growth in the economy as a whole. Strong competition for workers in the energy industry causes increased wages for workers in other industries as well because employers must offer competitive wages to attract workers. Increased wages and employment opportunities are particularly welcome in the WIRED region, which is experiencing long-term out-migration due, in part, to low wages and poor economic conditions.

But no industry can produce without workers, and there are signs that the energy industries future growth is currently constrained by the available workforce. The data presented in this report provides positive news for businesses and economic and workforce developers attempting to address workforce shortages. In general, energy jobs can be filled by workers with short-term on-the-job training, rather than long-term formal education programs. Further, the jobs in the energy industry do not require a unique or rare skill set; rather, the skills required in energy jobs are similar to the skills required in the Montana economy as a whole, allowing the easy transfer of workers from other industries to the energy industry.

The State of Montana offers a number of programs designed to promote the energy industry in Montana and to address the challenges faced by the energy industry in Montana. A selection of these programs is shown in Chart 5.1 on the following page. Questions about this report should be directed to the Research and Analysis Bureau of the Montana Department of Labor. Questions about Montana's energy industry and for information about opening or expanding an energy business in Montana should be directed to the Energy Promotion Office of the Montana Department of Commerce or to the Economic Development Office in the Office of Governor Brian Schweitzer.

Table 5.1. Montana Government Agencies that Promote the Energy Industry or Provide Workforce Services	
Program	**Description**
Montana Department of Labor, Workforce Services Division P.O. Box 1728 Helena, MT 59624-1728 406-444-4100 www.wsd.dli.mt.gov	The Workforce Services Division develops and maintains a high-quality workforce system for Montana that supports and enhances the economic health of the business community, as well as to provide a prepared workforce. The Workforce Services Division offers worker training programs, worker to employer matching programs, and information on the Montana labor market. The Workforce Services Division houses the Research and Analysis Bureau, which produced this report.
The Governor's Office of Economic Development P.O. Box 200801 Helena, MT 59620-0801 406-444-5634 www.business.mt.gov	The Governor's Office of Economic Development serves as the state's primarily liaison with businesses and economic development groups in Montana. The Office works to strengthen and diversify the state's economy, and includes the energy sector as one of its targeted industries.
Department of Commerce, Energy Promotion Division 301 S. Park Ave Helena, MT 59601 406-841-2030 www.commerce.mt.gov/energy	The Energy Promotion and Development Division is the front-line for state support for energy development in Montana, and its staff is poised to assist in all aspects of potential energy projects, both energy production facilities and the supportive energy delivery infrastructure. The Division works directly with the Governor, the Governor's Office of Economic Development, and other state agencies to help facilitate processes related to permitting, siting, workforce, and financial assistance.
Department of Commerce, Business Resources Division 301 S. Park Ave Helena, MT 59601 406-841-2730 www.businessresources.mt.gov	The Business Resources Division administers a variety of programs aimed at improving and diversifying Montana's economic and business climate. The Division offers both financial and technical assistance for Montana businesses.

Montana
Department of Labor and Industry

Research & Analysis
BUREAU
Montana Department of Labor and Industry

P. O. Box 1728
Helena, MT 59624-1728
www.ourfactsyourfuture.org

Phone: (406) 444-2430
Toll-free: (800) 541-3904
Fax: (406) 444-2638

This public document was intended for web distribution. Printed copies are available upon request, and are published at an estimated cost of $1.01 per copy, which includes $1.01 for printing and $0.00 for distribution.